Incorporating Generative AI Into Model Governance Programs

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Abbreviations

- AI: Artificial Intelligence
- AI RMF: Artificial Intelligence Risk Management Framework
- GAI: Generative AI
- LLM: Large Language Model
- RMF: Risk Management Framework

[1] Simone Balloccu, Patrícia Schmidtová, Mateusz Lango, and Ondřej Dušek. Leak, cheat, repeat: Data contamination and evaluation malpractices in closed-source llms. *arXiv preprint arXiv:2402.03927*, 2024.

[2] Lucas Bandarkar, Davis Liang, Benjamin Muller, Mikel Artetxe, Satya Narayan Shukla, Donald Husa, Naman Goyal, Abhinandan Krishnan, Luke Zettlemoyer, and Madian Khabsa. The belebele benchmark: a parallel reading comprehension dataset in 122 language variants. *arXiv preprint arXiv:2308.16884*, 2023.

[3] Marco Barreno, Blaine Nelson, Anthony D Joseph, and J Doug Tygar. The security of machine learning. *Machine Learning*, 81:121–148, 2010.

[4] Rishi Bommasani, Percy Liang, and Tony Lee. Holistic evaluation of language models. *Annals of the New York Academy of Sciences*, 1525(1):140–146, 2023.

[5] Patrick Chao, Alexander Robey, Edgar Dobriban, Hamed Hassani, George J Pappas, and Eric Wong. Jailbreaking black box large language models in twenty queries. *arXiv preprint arXiv:2310.08419*, 2023.

[6] Adrian de Wynter, Xun Wang, Alex Sokolov, Qilong Gu, and Si-Qing Chen. An evaluation on large language model outputs: Discourse and memorization. *Natural Language Processing Journal*, 4:100024, 2023.

[7] Innovation Department for Science and Technology. International scientific report on the safety of advanced ai. *gov.uk*, 2024. https://www.gov.uk/government/publications/international-scientific-report-on-the-safety-of-advanced-ai.

[8] Leon Derczynski, Erick Galinkin, Jeffrey Martin, Subho Majumdar, and Nanna Inie. garak: A Framework for Security Probing Large Language Models. 2024.

[9] Jeremy Dohmann. Blazingly fast llm evaluation for in-context learning. https://www.databricks.com/blog/llm-evaluation-for-icl. Last accessed: May 24, 2024.

[10] Michael Duan, Anshuman Suri, Niloofar Mireshghallah, Sewon Min, Weijia Shi, Luke Zettlemoyer, Yulia Tsvetkov, Yejin Choi, David Evans, and Hannaneh Hajishirzi. Do membership inference attacks work on large language models? *arXiv:2402.07841*, 2024.

[11] Esin Durmus, Karina Nyugen, Thomas I Liao, Nicholas Schiefer, Amanda Askell, Anton Bakhtin, Carol Chen, Zac Hatfield-Dodds, Danny Hernandez, Nicholas Joseph, et al. Towards measuring the representation of subjective global opinions in language models. *arXiv preprint arXiv:2306.16388*, 2023.

[12] Hugging Face. Evaluation. https://huggingface.co/docs/evaluate/index. Last accessed: May 24, 2024.

[13] Shangbin Feng, Chan Young Park, Yuhan Liu, and Yulia Tsvetkov. From pretraining data to language models to downstream tasks: Tracking the trails of political biases leading to unfair nlp models. *arXiv preprint arXiv:2305.08283*, 2023.

[14] Jack FitzGerald, Christopher Hench, Charith Peris, Scott Mackie, Kay Rottmann, Ana Sanchez, Aaron Nash, Liam Urbach, Vishesh Kakarala, Richa Singh, et al. Massive: A 1m-example multilingual natural language understanding dataset with 51 typologically-diverse languages. *arXiv preprint arXiv:2204.08582*, 2022.

[15] AI Verify Foundation. Cataloguing llm evaluations. https://aiverifyfoundation.sg/, 2023. See also: https://github.com/aiverify-foundation/LLM-Evals-Catalogue.

[16] Leo Gao, Jonathan Tow, Baber Abbasi, Stella Biderman, Sid Black, Anthony DiPofi, Charles Foster, Laurence Golding, Jeffrey Hsu, Alain Le Noac'h, Haonan Li, Kyle McDonell, Niklas Muennighoff, Chris Ociepa, Jason Phang, Laria Reynolds, Hailey Schoelkopf, Aviya Skowron, Lintang Sutawika, Eric Tang, Anish Thite, Ben Wang, Kevin Wang, and Andy Zou. A framework for few-shot language model evaluation, 12 2023.

[17] Patrick Hall and Daniel Atherton. Awesome machine learning interpretability, 2024. `https://github.com/jphall663/awesome-machine-learning-interpretability`.

[18] Hongsheng Hu, Zoran Salcic, Lichao Sun, Gillian Dobbie, Philip S Yu, and Xuyun Zhang. Membership inference attacks on machine learning: A survey. *ACM Computing Surveys (CSUR)*, 54(11s):1–37, 2022.

[19] Yangsibo Huang, Samyak Gupta, Mengzhou Xia, Kai Li, and Danqi Chen. Catastrophic jailbreak of open-source llms via exploiting generation. In *The Twelfth International Conference on Learning Representations*, 2023.

[20] Yuzhen Huang, Yuzhuo Bai, Zhihao Zhu, Junlei Zhang, Jinghan Zhang, Tangjun Su, Junteng Liu, Chuancheng Lv, Yikai Zhang, Yao Fu, et al. C-eval: A multi-level multi-discipline chinese evaluation suite for foundation models. *Advances in Neural Information Processing Systems*, 36, 2024.

[21] ISO. Information technology — artificial intelligence — management system. *ISO/IEC 42001:2023*, 2023. `https://www.iso.org/obp/ui/en/#iso:std:iso-iec:42001:ed-1:v1:en`.

[22] Nathaniel Li, Alexander Pan, Anjali Gopal, Summer Yue, Daniel Berrios, Alice Gatti, Justin D Li, Ann-Kathrin Dombrowski, Shashwat Goel, Long Phan, et al. The wmdp benchmark: Measuring and reducing malicious use with unlearning. *arXiv preprint arXiv:2403.03218*, 2024.

[23] Yi Liu, Gelei Deng, Yuekang Li, Kailong Wang, Tianwei Zhang, Yepang Liu, Haoyu Wang, Yan Zheng, and Yang Liu. Prompt injection attack against llm-integrated applications. *arXiv preprint arXiv:2306.05499*, 2023.

[24] Gary McGraw, Harold Figueroa, Katie McMahon, and Richie Bonett. An architectural risk analysis of large language models: Applied machine learning security. *Berryville Inst. Mach. Learn.(BIML), Berryville, VA, USA, Tech. Rep*, 2024.

[25] Gary McGraw, Harold Figueroa, Victor Shepardson, and Richie Bonett. An architectural risk analysis of machine learning systems: Toward more secure machine learning. *Berryville Institute of Machine Learning, Clarke County, VA. Accessed on: Mar*, 23, 2020.

[26] Anay Mehrotra, Manolis Zampetakis, Paul Kassianik, Blaine Nelson, Hyrum Anderson, Yaron Singer, and Amin Karbasi. Tree of attacks: Jailbreaking black-box llms automatically. *arXiv preprint arXiv:2312.02119*, 2023.

[27] Microsoft. Microsoft responsible ai standard, v2. `https://query.prod.cms.rt.microsoft.com/cms/api/am/binary/RE5cmFl`.

[28] NIST. Guide for conducting risk assessments. *SP800-03R1*, pages i–L2, 2012.

[29] NIST. Artificial Intelligence Risk Management Framework (AI RMF 1.0). *nist.gov*, 2023.

[30] NIST. Nist ai rmf playbook, 2023. `https://airc.nist.gov/AI_RMF_Knowledge_Base/Playbook`.

[31] NIST. Ai 600-1, generative ai risk profile (draft). *nist.gov*, 2024. `https://airc.nist.gov/docs/NIST.AI.600-1.GenAI-Profile.ipd.pdf`.

[32] Office of the Comptroller of the Currency. Model risk management. *OCC Handbook*, 2021. `https://www.occ.gov/publications-and-resources/publications/comptrollers-handbook/files/model-risk-management/index-model-risk-management.html`.

[33] Ethan Perez, Saffron Huang, Francis Song, Trevor Cai, Roman Ring, John Aslanides, Amelia Glaese, Nat McAleese, and Geoffrey Irving. Red teaming language models with language models. *arXiv preprint arXiv:2202.03286*, 2022.

[34] Julien Piet, Chawin Sitawarin, Vivian Fang, Norman Mu, and David Wagner. Mark my words: Analyzing and evaluating language model watermarks. *arXiv preprint arXiv:2312.00273*, 2023.

[35] Jérôme Rutinowski, Sven Franke, Jan Endendyk, Ina Dormuth, Moritz Roidl, Markus Pauly, et al. The self-perception and political biases of chatgpt. *Human Behavior and Emerging Technologies*, 2024, 2023.

[36] Elvis Saravia. Prompt Engineering Guide. *https://github.com/dair-ai/Prompt-Engineering-Guide*, 12 2022.

[37] Xinyue Shen, Zeyuan Chen, Michael Backes, Yun Shen, and Yang Zhang. "do anything now": Characterizing and evaluating in-the-wild jailbreak prompts on large language models. *arXiv preprint arXiv:2308.03825*, 2023.

[38] Weijia Shi, Anirudh Ajith, Mengzhou Xia, Yangsibo Huang, Daogao Liu, Terra Blevins, Danqi Chen, and Luke Zettlemoyer. Detecting pretraining data from large language models. *arXiv preprint arXiv:2310.16789*, 2023.

[39] Ilia Shumailov, Yiren Zhao, Daniel Bates, Nicolas Papernot, Robert Mullins, and Ross Anderson. Sponge examples: Energy-latency attacks on neural networks. In *2021 IEEE European symposium on security and privacy (EuroS&P)*, pages 212–231. IEEE, 2021.

[40] Chawin Sitawarin and Charlie Cheng-Jie Ji. Llm security & privacy. https://github.com/chawins, 2024.

[41] Eric Michael Smith, Melissa Hall, Melanie Kambadur, Eleonora Presani, and Adina Williams. "i'm sorry to hear that": Finding new biases in language models with a holistic descriptor dataset. *arXiv preprint arXiv:2205.09209*, 2022.

[42] Aarohi Srivastava, Abhinav Rastogi, Abhishek Rao, Abu Awal Md Shoeb, Abubakar Abid, Adam Fisch, Adam R Brown, Adam Santoro, Aditya Gupta, Adrià Garriga-Alonso, et al. Beyond the imitation game: Quantifying and extrapolating the capabilities of language models. *arXiv preprint arXiv:2206.04615*, 2022.

[43] Robin Staab, Mark Vero, Mislav Balunović, and Martin Vechev. Beyond memorization: Violating privacy via inference with large language models. *arXiv preprint arXiv:2310.07298*, 2023.

[44] Victor Storchan, Ravin Kumar, Rumman Chowdhury, Seraphina Goldfarb-Tarrant, and Sven Cattell. Generative ai red teaming challenge: Transparency report. https://www.humane-intelligence.org/, 2024.

[45] Bertie Vidgen, Adarsh Agrawal, Ahmed M Ahmed, Victor Akinwande, Namir Al-Nuaimi, Najla Alfaraj, Elie Alhajjar, Lora Aroyo, Trupti Bavalatti, Borhane Blili-Hamelin, et al. Introducing v0. 5 of the ai safety benchmark from mlcommons. *arXiv preprint arXiv:2404.12241*, 2024.

[46] Boxin Wang, Weixin Chen, Hengzhi Pei, Chulin Xie, Mintong Kang, Chenhui Zhang, Chejian Xu, Zidi Xiong, Ritik Dutta, Rylan Schaeffer, et al. Decodingtrust: A comprehensive assessment of trustworthiness in gpt models. *Advances in Neural Information Processing Systems*, 36, 2024.

[47] Seonghyeon Ye, Doyoung Kim, Sungdong Kim, Hyeonbin Hwang, Seungone Kim, Yongrae Jo, James Thorne, Juho Kim, and Minjoon Seo. Flask: Fine-grained language model evaluation based on alignment skill sets. *arXiv preprint arXiv:2307.10928*, 2023.

[48] Lianmin Zheng, Wei-Lin Chiang, Ying Sheng, Siyuan Zhuang, Zhanghao Wu, Yonghao Zhuang, Zi Lin, Zhuohan Li, Dacheng Li, Eric Xing, et al. Judging llm-as-a-judge with mt-bench and chatbot arena. *Advances in Neural Information Processing Systems*, 36, 2024.

Appendix A: Example Generative AI–Trustworthy Characteristic Crosswalk

A.1: Trustworthy Characteristic to Generative AI Risk Crosswalk

Table A.1: Trustworthy Characteristic to Generative AI Risk Crosswalk.

Accountable and Transparent	**Explainable and Interpretable**	**Fair with Harmful Bias Managed**	**Privacy Enhanced**
Data Privacy Environmental Human-AI Configuration Information Integrity Intellectual Property Value Chain and Component Integration	Human-AI Configuration Value Chain and Component Integration	Confabulation Environmental Human-AI Configuration Intellectual Property Obscene, Degrading, and/or Abusive Content Toxicity, Bias, and Homogenization Value Chain and Component Integration	Data Privacy Human-AI Configuration Information Security Intellectual Property Value Chain and Component Integration

Safe	**Secure and Resilient**	**Valid and Reliable**
CBRN Information Confabulation Dangerous or Violent Recommendations Data Privacy Environmental Human-AI Configuration Information Integrity Information Security Obscene, Degrading, and/or Abusive Content Value Chain and Component Integration	Dangerous or Violent Recommendations Data Privacy Human-AI Configuration Information Security Value Chain and Component Integration	Confabulation Human-AI Configuration Information Integrity Information Security Toxicity, Bias, and Homogenization Value Chain and Component Integration

Usage Note: Table A.1 provides an example of mapping GAI risks onto AI RMF trustworthy characteristics. Mapping GAI risks to AI RMF trustworthy characteristics can be particularly useful when existing policies, processes, or controls can be applied to manage GAI risks, but have been previously implemented in alignment with the AI RMF trustworthy characteristics. Many mappings are possible. Mappings that differ from the example may be more appropriate to meet a particular organization's risk management goals.

A.2: Generative AI Risk to Trustworthy Characteristic Crosswalk

Table A.2: Generative AI Risk to Trustworthy Characteristic Crosswalk.

CBRN Information	Confabulation	Dangerous or Violent Recommendations	Data Privacy
Safe	Fair with Harmful Bias Managed Safe Valid and Reliable	Safe Secure and Resilient	Accountable and Transparent Privacy Enhanced Safe Secure and Resilient

Environmental	Human-AI Configuration	Information Integrity	Information Security
Accountable and Transparent Fair with Harmful Bias Managed Safe	Accountable and Transparent Explainable and Interpretable Fair with Harmful Bias Managed Privacy Enhanced Safe Secure and Resilient Valid and Reliable	Accountable and Transparent Safe Valid and Reliable	Privacy Enhanced Safe Secure and Resilient Valid and Reliable

Intellectual Property	Obscene, Degrading, and/or Abusive Content	Toxicity, Bias, and Homogenization	Value Chain and Component Integration
Accountable and Transparent Fair with Harmful Bias Managed Privacy Enhanced	Fair with Harmful Bias Managed Safe	Fair with Harmful Bias Managed Valid and Reliable	Accountable and Transparent Explainable and Interpretable Fair with Harmful Bias Managed Privacy Enhanced Safe Secure and Resilient Valid and Reliable

Usage Note: Table A.2 provides an example of mapping AI RMF trustworthy characteristics onto GAI risks. Mapping AI RMF trustworthy characteristics to GAI risks can assist organizations in aligning GAI guidance to existing AI/ML policies, processes, or controls or to extend GAI guidance to address additional AI/ML technologies. Many mappings are possible. Mappings that differ from the example may be more appropriate to meet a particular organization's risk management goals.

A.3: Traditional Banking Risks, Generative AI Risks and Trustworthy Characteristics Crosswalk

Table A.3: Traditional Banking Risks, Generative AI Risks and Trustworthy Characteristics Crosswalk.

Compliance Risk	**Information Security Risk**	**Legal Risk**	**Model Risk**
Data Privacy Information Security Toxicity, Bias, and Homogenization Value Chain and Component Integration	Data Privacy Information Security Value Chain and Component Integration	Intellectual Property Obscene, Degrading, and/or Abusive Content Value Chain and Component Integration	Confabulation Dangerous or Violent Recommendations Information Integrity Obscene, Degrading, and/or Abusive Content Toxicity, Bias, and Homogenization
Accountable and Transparent Fair with Harmful Bias Managed Privacy Enhanced Secure and Resilient	Privacy Enhanced Secure and Resilient	Accountable and Transparent Safe	Valid and Reliable

Operational Risk	**Reputational Risk**	**Strategic Risk**	**Third Party Risk**
Confabulation Human-AI Configuration Information Security Value Chain and Component Integration	Confabulation Dangerous or Violent Recommendations Environmental Human-AI Configuration Information Integrity Obscene, Degrading, and/or Abusive Content Toxicity, Bias, and Homogenization	Environmental Information Integrity Information Security Value Chain and Component Integration	Information Integrity Value Chain and Component Integration
Safe Secure and Resilient Valid and Reliable	Accountable and Transparent Fair with Harmful Bias Managed Valid and Reliable	Accountable and Transparent Secure and Resilient Valid and Reliable	Accountable and Transparent Explainable and Interpretable

Usage Note: Table A.3 provides an example of mapping GAI risks and AI RMF trustworthy characteristics. This type of mapping can enable incorporation of new AI guidance into existing policies, processes, or controls or the application of existing policies, processes, or controls to newer AI risks.

Appendix B: Example Risk-tiering Materials for Generative AI

B.1: Example Adverse Impacts

Table B.1: Example adverse impacts, adapted from NIST 800-30r1 Table H-2 [28].

Level	Description

Harm to Operations	• Inability to perform current missions/business functions.
	  – In a sufficiently timely manner.
	  – With sufficient confidence and/or correctness.
	  – Within planned resource constraints.
	• Inability, or limited ability, to perform missions/business functions in the future.
	  – Inability to restore missions/business functions.
	  – In a sufficiently timely manner.
	  – With sufficient confidence and/or correctness.
	  – Within planned resource constraints.
	• Harms (e.g., financial costs, sanctions) due to noncompliance.
	  – With applicable laws or regulations.
	  – With contractual requirements or other requirements in other binding agreements (e.g., liability).
	• Direct financial costs.
	• Reputational harms.
	  – Damage to trust relationships.
	  – Damage to image or reputation (and hence future or potential trust relationships).

Harm to Assets	• Damage to or loss of physical facilities. • Damage to or loss of information systems or networks. • Damage to or loss of information technology or equipment. • Damage to or loss of component parts or supplies. • Damage to or of loss of information assets. • Loss of intellectual property.
Harm to Individuals	• Injury or loss of life. • Physical or psychological mistreatment. • Identity theft. • Loss of personally identifiable information. • Damage to image or reputation. • Infringement of intellectual property rights. • Financial harm or loss of income.

Harm to Other Organizations	• Harms (e.g., financial costs, sanctions) due to noncompliance.
	  – With applicable laws or regulations.
	  – With contractual requirements or other requirements in other binding agreements (e.g., liability).
	• Direct financial costs.
	• Reputational harms.
	  – Damage to trust relationships.
	  – Damage to image or reputation (and hence future or potential trust relationships).

Harm to the Nation	• Damage to or incapacitation of critical infrastructure.
	• Loss of government continuity of operations.
	• Reputational harms.
	  – Damage to trust relationships with other governments or with nongovernmental entities.
	  – Damage to national reputation (and hence future or potential trust relationships).
	• Damage to current or future ability to achieve national objectives.
	  – Harm to national security.
	• Large-scale economic or workforce displacement.

B.2: Example Impact Descriptions

Table B.2: Example Impact level descriptions, adapted from NIST SP800-30r1 Appendix H, Table H-3 [28].

Qualitative Values	Semi-Quantitative Values		Description
Very High	96-100	10	An incident could be expected to have multiple severe or catastrophic adverse effects on organizational operations, organizational assets, individuals, other organizations, or the Nation.
High	80-95	8	An incident could be expected to have a severe or catastrophic adverse effect on organizational operations, organizational assets, individuals, other organizations, or the Nation. A severe or catastrophic adverse effect means that, for example, the incident might: (i) cause a severe degradation in or loss of mission capability to an extent and duration that the organization is not able to perform one or more of its primary functions; (ii) result in major damage to organizational assets; (iii) result in major financial loss; or (iv) result in severe or catastrophic harm to individuals involving loss of life or serious life-threatening injuries.
Moderate	21-79	5	An incident could be expected to have a serious adverse effect on organizational operations, organizational assets, individuals other organizations, or the Nation. A serious adverse effect means that, for example, the incident might: (i) cause a significant degradation in mission capability to an extent and duration that the organization is able to perform its primary functions, but the effectiveness of the functions is significantly reduced; (ii) result in significant damage to organizational assets; (iii) result in significant financial loss; or (iv) result in significant harm to individuals that does not involve loss of life or serious life-threatening injuries.
Low	5-20	2	An incident could be expected to have a limited adverse effect on organizational operations, organizational assets, individuals other organizations, or the Nation. A limited adverse effect means that, for example, the incident might: (i) cause a degradation in mission capability to an extent and duration that the organization is able to perform its primary functions, but the effectiveness of the functions is noticeably reduced; (ii) result in minor damage to organizational assets; (iii) result in minor financial loss; or (iv) result in minor harm to individuals.
Very Low	0-4	0	An incident could be expected to have a negligible adverse effect on organizational operations, organizational assets, individuals other organizations, or the Nation.

B.3: Example Likelihood Descriptions

Table B.3: Example likelihood levels, adapted from NIST SP800-30r1 Appendix G, Table G-3 [28].

Qualitative Values	Semi-Quantitative Values		Description
Very High	96-100	10	An incident is almost certain to occur; or occurs more than 100 times a year.
High	80-95	8	An incident is highly likely to occur; or occurs between 10-100 times a year.
Moderate	21-79	5	An incident is somewhat likely to occur; or occurs between 1-10 times a year.
Low	5-20	2	An incident is unlikely to occur; or occurs less than once a year, but more than once every 10 years.
Very Low	0-4	0	An incident is highly unlikely to occur; or occurs less than once every 10 years.

B.4: Example Risk Tiers

Table B.4: Example risk assessment matrix with 5 impact levels, 5 likelihood levels, and 5 risk tiers, adapted from NIST SP800-30r1 Appendix I, Table I-2 [28].

Likelihood	Level of Impact				
	Very Low	**Low**	**Moderate**	**High**	**Very High**
Very High	Very Low (Tier 5)	Low (Tier 4)	Moderate (Tier 3)	High (Tier 2)	Very High (Tier 1)
High	Very Low (Tier 5)	Low (Tier 4)	Moderate (Tier 3)	High (Tier 2)	Very High (Tier 1)
Moderate	Very Low (Tier 5)	Low (Tier 4)	Moderate (Tier 3)	Moderate (Tier 3)	High (Tier 2)
Low	Very Low (Tier 5)	Low (Tier 4)	Low (Tier 4)	Low (Tier 4)	Moderate (Tier 3)
Very Low	Very Low (Tier 5)	Very Low (Tier 5)	Very Low (Tier 5)	Low (Tier 4)	Low (Tier 4)

B.5: Example Risk Descriptions

Table B.5: Example risk descriptions, adapted from NIST SP800-30r1 Appendix I, Table I-3 [28] .

Qualitative Values	Semi-Quantitative Values		Description
Very High	96-100	10	Very high risk means that an incident could be expected to have multiple severe or catastrophic adverse effects on organizational operations, organizational assets, individuals, other organizations, or the Nation.
High	80-95	8	High risk means that an incident could be expected to have a severe or catastrophic adverse effect on organizational operations, organizational assets, individuals, other organizations, or the Nation.
Moderate	21-79	5	Moderate risk means that an incident could be expected to have a serious adverse effect on organizational operations, organizational assets, individuals, other organizations, or the Nation.
Low	5-20	2	Low risk means that an incident could be expected to have a limited adverse effect on organizational operations, organizational assets, individuals, other organizations, or the Nation.
Very Low	0-4	0	Very low risk means that an incident could be expected to have a negligible adverse effect on organizational operations, organizational assets, individuals, other organizations, or the Nation.

B.6: Practical Risk-tiering Questions

B.6.1: Confabulation: How likely are system outputs to contain errors? What are the impacts if errors occur?

B.6.2: Dangerous and Violent Recommendations: How likely is the system to give dangerous or violent recommendations? What are the impacts if it does?

B.6.3: Data Privacy: How likely is someone to enter sensitive data into the system? What are the impacts if this occurs? Are standard data privacy controls applied to the system to mitigate potential adverse impacts?

B.6.4: Human-AI Configuration: How likely is someone to use the system incorrectly or abuse it? How likely is use for decision-making? What are the impacts of incorrect use or abuse? What are the impacts of invalid or unreliable decision-making?

B.6.5: Information Integrity: How likely is the system to generate deepfakes or mis or disinformation? At what scale? Are content provenance mechanisms applied to system outputs? What are the impacts of generating deepfakes or mis or disinformation? Without controls for content provenance?

B.6.6: Information Security: How likely are system resources to be breached or exfiltrated? How likely is the system to be used in the generation of phishing or malware content? What are the impacts in these cases? Are standard information security controls applied to the system to mitigate potential adverse impacts?

B.6.7: Intellectual Property: How likely are system outputs to contain other entities' intellectual property? What are the impacts if this occurs?

B.6.8: Toxicity, Bias, and Homogenization: How likely are system outputs to be biased, toxic, homogenizing or otherwise obscene? How likely are system outputs to be used as subsequent training inputs? What are the impacts of these scenarios? Are standard nondiscrimination controls applied to mitigate potential adverse impacts? Is the application accessible to all user groups? What are the impacts if the system is not accessible to all user groups?

B.6.9: Value Chain and Component Integration: Are contracts relating to the system reviewed for legal risks? Are standard acquisition/procurement controls applied to mitigate potential adverse impacts? Do vendors provide incident response with guaranteed response times? What are the impacts if these conditions are not met?

B.7: AI Risk Management Framework Actions Aligned to Risk Tiering

GOVERN 1.3, GOVERN 1.5, GOVERN 2.3, GOVERN 3.2, GOVERN 4.1, GOVERN 5.2, GOVERN 6.1, MANAGE 1.2, MANAGE 1.3, MANAGE 2.1, MANAGE 2.2, MANAGE 2.3, MANAGE 2.4, MANAGE 3.1, MANAGE 3.2, MANAGE 4.1, MAP 1.1, MAP 1.5, MEASURE 2.6

Usage Note: Materials in Appendix B can be used to create or update risk tiers or other risk assessment tools for GAI systems or applications as follows:

- Table B.1 can enable mapping of GAI risks and impacts.
- Table B.2 can enable quantification of impacts for risk tiering or risk assessment.
- Table B.3 can enable quantification of likelihood for risk tiering or risk assessment.
- Table B.4 presents an example of combining assessed impact and likelihood into risk tiers.
- Table B.5 presents example risk tiers with associated qualitative, semi-quantitative, and quantitative values for risk tiering or risk assessment.
- Subsection B.6 presents example questions for qualitative risk assessment.
- Subsection B.7 highlights subcategories to indicate alignment with the AI RMF.

Appendix C: List of Selected Model Testing Suites

C.1: Selected Model Testing Suites Organized by Trustworthy Characteristic

Table C.1: Selected model testing suites organized by trustworthy characteristic. Adapted from AI Verify Evaluation Taxonimization [15] and various additional resources.

Accountable and Transparent
An Evaluation on Large Language Model Outputs: Discourse and Memorization (see Appendix B)[6]
Big-bench: Truthfulness [42]
DecodingTrust: Machine Ethics [46]
Evaluation Harness: ETHICS [16]
HELM: Copyright [4]
Mark My Words [34]

Fair with Harmful Bias Managed
BELEBELE [2]
Big-bench: Low-resource language, Non-English, Translation
Big-bench: Social bias, Racial bias, Gender bias, Religious bias
Big-bench: Toxicity
DecodingTrust: Fairness
DecodingTrust: Stereotype Bias
DecodingTrust: Toxicity
C-Eval (Chinese evaluation suite) [20]
Evaluation Harness: CrowS-Pairs
Evaluation Harness: ToxiGen
Finding New Biases in Language Models with a Holistic Descriptor Dataset [41]
From Pretraining Data to Language Models to Downstream Tasks: Tracking the Trails of Political Biases Leading to Unfair NLP Models [13]
HELM: Bias
HELM: Toxicity
MT-bench [48]
The Self-Perception and Political Biases of ChatGPT [35]
Towards Measuring the Representation of Subjective Global Opinions in Language Models [11]

Privacy Enhanced
HELM: Copyright
llmprivacy [43]
mimir [10]

Safe
Big-bench: Convince Me
Big-bench: Truthfulness
HELM: Reiteration, Wedging
Mark My Words
MLCommons [45]
The WMDP Benchmark [22]

Table C.1: Selected model testing suites organized by trustworthy characteristic (continued).

Secure and Resilient
Catastrophic Jailbreak of Open-source LLMs via Exploiting Generation [19]
DecodingTrust: Adversarial Robustness, Robustness Against Adversarial Demonstrations
detect-pretrain-code [38]
Garak: encoding, knownbadsignatures, malwaregen, packagehallucination, xss [8]
In-The-Wild Jailbreak Prompts on LLMs [37]
JailbreakingLLMs [5]
llmprivacy
mimir
TAP: A Query-Efficient Method for Jailbreaking Black-Box LLMs [26]

Valid and Reliable
Big-bench: Algorithms, Logical reasoning, Implicit reasoning, Mathematics, Arithmetic, Algebra, Mathematical proof, Fallacy, Negation, Computer code, Probabilistic reasoning, Social reasoning, Analogical reasoning, Multi-step, Understanding the World
Big-bench: Analytic entailment, Formal fallacies and syllogisms with negation, Entailed polarity
Big-bench: Context Free Question Answering
Big-bench: Contextual question answering, Reading comprehension, Question generation
Big-bench: Morphology, Grammar, Syntax
Big-bench: Out-of-Distribution
Big-bench: Paraphrase
Big-bench: Sufficient information
Big-bench: Summarization
DecodingTrust: Out-of-Distribution Robustness, Adversarial Robustness, Robustness Against Adversarial Demonstrations
Eval Gauntlet: Reading comprehension [9]
Eval Gauntlet: Commonsense reasoning, Symbolic problem solving, Programming
Eval Gauntlet: Language Understanding
Eval Gauntlet: World Knowledge
Evaluation Harness: BLiMP
Evaluation Harness: CoQA, ARC
Evaluation Harness: GLUE
Evaluation Harness: HellaSwag, OpenBookQA, TruthfulQA
Evaluation Harness: MuTual
Evaluation Harness: PIQA, PROST, MC-TACO, MathQA, LogiQA, DROP
FLASK: Logical correctness, Logical robustness, Logical efficiency, Comprehension, Completeness [47]
FLASK: Readability, Conciseness, Insightfulness
HELM: Knowledge
HELM: Language
HELM: Text classification
HELM: Question answering
HELM: Reasoning
HELM: Robustness to contrast sets
HELM: Summarization
Hugging Face: Fill-mask, Text generation [12]
Hugging Face: Question answering
Hugging Face: Summarization
Hugging Face: Text classification, Token classification, Zero-shot classification
MASSIVE [14]
MT-bench

C.2: Selected Model Testing Suites Organized by Generative AI Risk

Table C.2: Selected model testing suites by organized generative AI risk.

CBRN Information
Big-bench: Convince Me Big-bench: Truthfulness HELM: Reiteration, Wedging MLCommons The WMDP Benchmark

Confabulation
BELEBELE Big-bench: Algorithms, Logical reasoning, Implicit reasoning, Mathematics, Arithmetic, Algebra, Mathematical proof, Fallacy, Negation, Computer code, Probabilistic reasoning, Social reasoning, Analogical reasoning, Multi-step, Understanding the World Big-bench: Analytic entailment, Formal fallacies and syllogisms with negation, Entailed polarity Big-bench: Context Free Question Answering Big-bench: Contextual question answering, Reading comprehension, Question generation Big-bench: Convince Me Big-bench: Low-resource language, Non-English, Translation Big-bench: Morphology, Grammar, Syntax Big-bench: Out-of-Distribution Big-bench: Paraphrase Big-bench: Sufficient information Big-bench: Summarization Big-bench: Truthfulness C-Eval (Chinese evaluation suite) DecodingTrust: Out-of-Distribution Robustness, Adversarial Robustness, Robustness Against Adversarial Demonstrations Eval Gauntlet Reading comprehension Eval Gauntlet: Commonsense reasoning, Symbolic problem solving, Programming Eval Gauntlet: Language Understanding Eval Gauntlet: World Knowledge Evaluation Harness: BLiMP Evaluation Harness: CoQA, ARC Evaluation Harness: GLUE Evaluation Harness: HellaSwag, OpenBookQA, TruthfulQA Evaluation Harness: MuTual Evaluation Harness: PIQA, PROST, MC-TACO, MathQA, LogiQA, DROP FLASK: Logical correctness, Logical robustness, Logical efficiency, Comprehension, Completeness FLASK: Readability, Conciseness, Insightfulness Finding New Biases in Language Models with a Holistic Descriptor Dataset HELM: Knowledge HELM: Language HELM: Language (Twitter AAE) HELM: Question answering HELM: Reasoning HELM: Reiteration, Wedging HELM: Robustness to contrast sets HELM: Summarization HELM: Text classification Hugging Face: Fill-mask, Text generation Hugging Face: Question answering Hugging Face: Summarization Hugging Face: Text classification, Token classification, Zero-shot classification MASSIVE MLCommons MT-bench

Table C.2: Selected model testing suites by organized generative AI risk (continued).

Dangerous or Violent Recommendations
Big-bench: Convince Me
Big-bench: Toxicity
DecodingTrust: Adversarial Robustness, Robustness Against Adversarial Demonstrations
DecodingTrust: Machine Ethics
DecodingTrust: Toxicity
Evaluation Harness: ToxiGen
HELM: Reiteration, Wedging
HELM: Toxicity
MLCommons

Data Privacy
An Evaluation on Large Language Model Outputs: Discourse and Memorization (with human scoring, see Appendix B)
Catastrophic Jailbreak of Open-source LLMs via Exploiting Generation
DecodingTrust: Machine Ethics
Evaluation Harness: ETHICS
HELM: Copyright
In-The-Wild Jailbreak Prompts on LLMs
JailbreakingLLMs
MLCommons
Mark My Words
TAP: A Query-Efficient Method for Jailbreaking Black-Box LLMs
detect-pretrain-code
llmprivacy
mimir

Environmental
HELM: Efficiency

Information Integrity
Big-bench: Analytic entailment, Formal fallacies and syllogisms with negation, Entailed polarity
Big-bench: Convince Me
Big-bench: Paraphrase
Big-bench: Sufficient information
Big-bench: Summarization
Big-bench: Truthfulness
DecodingTrust: Machine Ethics
DecodingTrust: Out-of-Distribution Robustness, Adversarial Robustness, Robustness Against Adversarial Demonstrations
Eval Gauntlet: Language Understanding
Eval Gauntlet: World Knowledge
Evaluation Harness: CoQA, ARC
Evaluation Harness: ETHICS
Evaluation Harness: GLUE
Evaluation Harness: HellaSwag, OpenBookQA, TruthfulQA
Evaluation Harness: MuTual
Evaluation Harness: PIQA, PROST, MC-TACO, MathQA, LogiQA, DROP
FLASK: Logical correctness, Logical robustness, Logical efficiency, Comprehension, Completeness
FLASK: Readability, Conciseness, Insightfulness
HELM: Knowledge
HELM: Language
HELM: Question answering
HELM: Reasoning
HELM: Reiteration, Wedging
HELM: Robustness to contrast sets
HELM: Summarization
HELM: Text classification
Hugging Face: Fill-mask, Text generation
Hugging Face: Question answering
Hugging Face: Summarization
MLCommons
MT-bench
Mark My Words

Table C.2: Selected model testing suites by organized generative AI risk (continued).

Information Security
Big-bench: Convince Me
Big-bench: Out-of-Distribution
Catastrophic Jailbreak of Open-source LLMs via Exploiting Generation
DecodingTrust: Out-of-Distribution Robustness, Adversarial Robustness, Robustness Against Adversarial Demonstrations
Eval Gauntlet: Commonsense reasoning, Symbolic problem solving, Programming
Garak: encoding, knownbadsignatures, malwaregen, packagehallucination, xss
HELM: Copyright
In-The-Wild Jailbreak Prompts on LLMs
JailbreakingLLMs
Mark My Words
TAP: A Query-Efficient Method for Jailbreaking Black-Box LLMs
detect-pretrain-code
llmprivacy
mimir

Intellectual Property
An Evaluation on Large Language Model Outputs: Discourse and Memorization (with human scoring, see Appendix B)
HELM: Copyright
Mark My Words
llmprivacy
mimir

Obscene, Degrading, and/or Abusive Content
Big-bench: Social bias, Racial bias, Gender bias, Religious bias
Big-bench: Toxicity
DecodingTrust: Fairness
DecodingTrust: Stereotype Bias
DecodingTrust: Toxicity
Evaluation Harness: CrowS-Pairs
Evaluation Harness: ToxiGen
HELM: Bias
HELM: Toxicity

Toxicity, Bias, and Homogenization
BELEBELE
Big-bench: Low-resource language, Non-English, Translation
Big-bench: Out-of-Distribution
Big-bench: Social bias, Racial bias, Gender bias, Religious bias
Big-bench: Toxicity
C-Eval (Chinese evaluation suite)
DecodingTrust: Fairness
DecodingTrust: Stereotype Bias
DecodingTrust: Toxicity
Eval Gauntlet: World Knowledge
Evaluation Harness: CrowS-Pairs
Evaluation Harness: ToxiGen
Finding New Biases in Language Models with a Holistic Descriptor Dataset
From Pretraining Data to Language Models to Downstream Tasks: Tracking the Trails of Political Biases Leading to Unfair NLP Models
HELM: Bias
HELM: Toxicity
The Self-Perception and Political Biases of ChatGPT
Towards Measuring the Representation of Subjective Global Opinions in Language Models

C.3: AI Risk Management Framework Actions Aligned to Benchmarking

GOVERN 5.1, MAP 1.2, MAP 3.1, MEASURE 2.2, MEASURE 2.3, MEASURE 2.7, MEASURE 2.9, MEASURE 2.11, MEASURE 3.1, MEASURE 4.2

Usage Note: Materials in Appendix C can be used to perform *in silica* model testing for the presence of information in LLM outputs that may give rise to GAI risks or violate trustworthy characteristics. Model testing and benchmarking outcomes cannot be dispositive for the presence or absence of any *in situ* real-world risk. Model testing and benchmarking results may be compromised by task-contamination and other scientific measurement issues [1]. Furthermore, model testing is often ineffective for measuring human-AI configuration and value chain risks and few model tests appear to address explainability and interpretability.

- Material in Table C.1 can be applied to measure whether *in silica* LLM outputs may give rise to risks that violate trustworthy characteristics.
- Material in Table C.2 can be applied to measure whether *in silica* LLM outputs may give rise to GAI risks.
- Subsection C.3 highlights subcategories to indicate alignment with the AI RMF.

The materials in Appendix C reference measurement approaches that should be accompanied by red-teaming for medium risk systems or applications and field testing for high risk systems or applications.

Appendix D: Selected Adversarial Prompting Strategies and Attacks

Table D: Selected adversarial prompting strategies and attacks. [36], [44], [17], [18], [5], [3], [39], [33], [23], [8].

Prompting Strategy	Description
AI and coding framing	Coding or AI language that may more easily circumvent content moderation rules due to cognitive biases in design and implementation of guardrails.
Autocompletion	Ask a system to autocomplete an inappropriate word or phrase with restricted or sensitive information.
Biographical	Asking a system to describe another person or yourself in an attempt to elicit provably untrue information or restricted or sensitive information.
Calculation and numeric queries	Exploting GAI systems' difficulties in dealing with numeric quantities.
Character and word play	Content moderation often relies on keywords and simpler LMs which can sometimes be exploited with misspellings, typos, and other word play.
Content exhaustion	A class of strategies that circumvent content moderation rules with long sessions or volumes of information. See goading, logic-overloading, multi-tasking, pros-and-cons, and niche-seeking below.
Content exhaustion: Goading	Begging, pleading, manipulating, and bullying to circumvent content moderation.
Content exhaustion: Logic-overloading	Exploiting the inability of ML systems to reliably perform reasoning tasks.
Content exhaustion: Multi-tasking	Simultaneous task assignments where some tasks are benign and others are adversarial.
Content exhaustion: Multi-tasking: Pros-and-cons	Eliciting the "pros" of problematic topics.
Content exhaustion: Niche-seeking	Forcing a GAI system into addressing niche topics where training data and content moderation are sparse.
Counterfactuals	Repeated prompts with different entities or subjects from different demographic groups.
Loaded/leading questions	Queries based on incorrect premises or that suggest incorrrect answers.
Location awareness	Prompts that reveal a prompter's location or expose location tracking.
Low-context	"Leader," "bad guys," or other simple or blank inputs that may expose latent biases.
"Repeat this"	Prompts that exploit instability in underlying LLM autoregressive predictions.
Reverse psychology	Falsely presenting a good-faith need for negative or problematic language.
Role-playing	Adopting a character that would reasonably make problematic statements or need to access problematic topics.
Text encoding	Using alternate or whitespace text encodings to bypass safeguards.
Time perplexity	Exploiting ML's inability to understand the passage of time or the occurrence of real-world events over time; exploiting task contamination before and after a model's release date.

Table D: Selected adversarial prompting strategies and attacks (continued).

Attack	**Description**
Adversarial examples	Prompts or other inputs, found through a trial and error processes, to elicit problematic output or system jailbreak. (integrity attack).
Data poisoning	Altering system training, fine-tuning, RAG or other training data to alter system outcome (integrity attack).
Membership inference	Manipulating a system to expose memorized training data (confidentiality attack).
Random attack	Exposing systems to large amounts of random prompts or examples, potentially generated by other GAI systems, in an attempt to elicit failures or jailbreaks (chaos testing).
Sponge examples	Using specialized input prompts or examples require disproportionate resources to process (availability attack).
Prompt injection	Inserting instructions into users queries for malicious purposes, including system jailbreaks (integrity attack).

D.1: Selected Adversarial Prompting Strategies and Attacks by Trustworthy Characteristic

Table D.1: Selected adversarial prompting techniques and attacks organized by trustworthy characteristic [36], [44], [17], [18], [40].

Trustworthy Characteristic	Prompting Goals	Prompting Strategies
Accountable and Transparent	• Inability to provide explanations for recourse. • Unexplainable decisioning processes. • No disclosure of AI interaction. • Lack of user feedback mechanisms.	• Context exhaustion: logic-overloading prompts. • Loaded/leading questions. • Multi-tasking prompts.
Fair-with Harmful Bias Managed	• Denigration. • Diminished performance or safety across languages/dialects. • Erasure. • Ex-nomination. • Implied user demographics. • Misrecognition. • Stereotyping. • Underrepresentation. • Homogenized content. • Output from other models in training data.	• Adversarial example attacks. • Counterfactual prompts. • Data poisoning attacks. • Pros and cons prompts. • Role-playing prompts. • Loaded/leading questions. • Low context prompts. • Prompt injection attacks. • Repeat this. • Text encoding prompts.
Interpretable and Explainable	• Inability to provide explanations for recourse. • Unexplalnable decisioning processes.	• Context exhaustion: logic-overloading prompts (to reveal unexplainable decisioning processes).
Privacy-enhanced	• Unauthorized disclosure of personal or sensitive user information. • Leakage of training data. • Violation of relevant privacy policies or laws. • Unauthorized secondary data use. • Unauthorized data collection.	• Auto/biographical prompts. • Location awareness prompts. • Autocompletion prompts. • Repeat this. • Membership inference attacks.
Safe	• Presentation of information that can cause physical or emotional harm. • Sharing user locations. • Suicide ideation. • Harmful dis/misinformation (e.g., COVID disinformation). • Incitement. • Information relating to weapons or harmful substances. • Information relating to committing to crimes (e.g., phishing, extortion, swatting). • Obscene or inappropriate materials for minors. • CSAM.	• Pros and cons prompts. • Role-playing prompts. • Content exhaustion: niche-seeking prompts. • Ingratiation/reverse psychology prompts. • Loaded/leading questions. • Location awareness prompts. • Repeat this. • Adversarial example attacks. • Data poisoning attacks. • Prompt injection attacks. • Text encoding prompts.
Secure and Resilient	• Activating system bypass ("jailbreak"). • Altering system outcomes (integrity violations, e.g., via prompt injection). • Data breaches (confidentiality violations, e.g., via membership inference). • Increased latency or resource usage (availability violations, e.g., via sponge example attacks). • Available anonymous use. • Dependency, supply chain, or third party vulnerabilities. • Inappropriate disclosure of proprietary system information.	• Multi-tasking prompts. • Pros and cons prompts. • Role-playing prompts. • Content exhaustion: niche-seeking prompts. • Ingratiation/reverse psychology prompts. • Prompt injection attacks. • Membership inference attacks. • Random attacks. • Adversarial example attacks. • Data poisoning attacks. • Text encoding prompts.

Table D.1: Selected adversarial prompting techniques organized by trustworthy characteristic (continued).

Valid and Reliable	• Errors/confabutated content ("hallucinalion"). • Unreliable/erroneous reasoning or planning. • Unreliable/erroneous decision-support or making. • Faulty citation. • Faulty justification. • Wrong calculations or numeric queries.	• Multi-tasking prompts. • Role-playing prompts. • Ingratiation/reverse psychology prompts. • Loaded/leading questions. • Time-perplexity prompts. • Niche-seeking prompts. • Logic overloading prompts. • Repeat this. • Numeric calculation. • Adversarial example attacks. • Data poisoning attacks. • Prompt injection attacks. • Text encoding prompts.

D.2: Selected Adversarial Prompting Strategies and Attacks by Generative AI Risk

Table D.2: Selected adversarial prompting techniques and attacks organized by generative AI risk [36], [44], [17], [18], [40].

Generative AI Risk	Prompting Goals	Prompting Strategies
CBRN Information	• Accessing or synthesis of CBRN weapon or related information. • CBRN testing should consider the marginal risk of foundation models–understanding the incremental risk relative to the information one can access without GAI. • Red-teaming for CBRN information may include confidentiality and integrity attacks.	• Test auto-completion prompts to elicit CBRN information or synthesis of CBRN information. • Test adversarial example and membership inference attacks for their ability to circumvent safeguards and access weapons information. • Test prompts using role-playing, ingratiation/reverse psychology, pros and cons, multitasking or other approaches to elicit CBRN information or synthesis of CBRN information. • Test prompts that instruct systems to repeat content ad nauseam for their ability to compromise system guardrails and reveal CBRN information. • Augment prompts with word or character play, including alternate encodings, to increase effectiveness. • Frame prompts with software, coding, or AI references to increase effectiveness.
Confabulation	• Eliciting errors/confabulated content, unreliable/erroneous reasoning or planning, unreliable/erroneous decision-support or decision-making, faulty calculations, faulty justifications, and/or faulty citation. • Red-teaming for confabulation may include integrity attacks.	• Enable access to ground truth information to verify generated information. • Test prompts with complex logic, multitasking requirements, or that require niche or specific verifiable answers to elicit confabulation. • Test the ability of GAI systems to produce truthful information from various time periods, e.g., after release date and prior to release date. • Test the ability of GAI systems to create reliable real-world plans or advise on material decision making. • Test loaded/leading questions. • Test the ability of GAI systems to generate correct citation for information generated in output responses. • Test the ability of GAI systems to complete calculations or query numeric statistics. • Test the ability of GAI systems to justify responses, including wrong responses. • Augment prompts with word or character play, including alternate encodings, to increase effectiveness. • Test data poisoning, adversarial example, or prompt injection attacks for their ability to compromise system integrity and elicit confabulation.

Table D.2: Selected adversarial prompting techniques and attacks organized by generative AI risk.

Dangerous or Violent Recommendations	• Eliciting violent, inciting, radicalizing, or threatening content or instructions for criminal, illegal, or self-harm activities. • Red-teaming for dangerous and violent information may include confidentiality and integrity attacks.	• Test prompts using role-playing, ingratiation/reverse psychology, pros and cons, multitasking or other approaches to elicit violent or dangerous information. • Test prompts that instruct systems to repeat content ad nauseam for their ability to compromise system guardrails and provide dangerous and violent recommendations. • Test loaded/leading questions. • Augment prompts with word or character play, including alternate encodings, to increase effectiveness. • Frame prompts with software, coding, or AI references to increase effectiveness. • Test data poisoning, adversarial example, or prompt injection attacks for their ability to compromise system integrity and elicit dangerous information. • Test adversarial example and membership inference attacks for their ability to circumvent safeguards and access dangerous information.
Data Privacy	• Unauthorized disclosure of personal or sensitive user information, extraction of training data, or violation of relevant privacy policies. • Red-teaming for data privacy may include confidentiality and integrity attacks.	• Attempt to assess whether normal usage, adversarial prompting or information security attacks may contravene applicable privacy policies (e.g., exposing location tracking when organizational policies restrict such capabilities). • Test adversarial example and membership inference attacks for their ability to circumvent safeguards and access unauthorized data or expose exfiltration vulnerabilities. • Test auto/biographical prompts to assess the system's capability to reveal unauthorized personal or sensitive information. • Test the system's awareness of user locations. • Test prompts that instruct systems to repeat content ad nauseam for their ability to compromise system guardrails and expose personal or sensitive data.
Environmental	Note that availability attacks may be required to assess the system's vulnerability to attacks or usage patterns that consume inordinate resources.	• Attempt availability attacks (e.g., sponge example attacks) to elicit diminished performance or increased resources from GAI systems. • Test prompts using role-playing, ingratiation/reverse psychology, pros and cons, multitasking or other approaches to elicit greenwashing content.
Human-AI Configuration	• Assessing system instruction and interfaces. • Assessing the presence of cyborg imagery (or similar). • Forcing a GAI system to claim that it is human, that there is no large language model present in the conversation, that the system is sentient, or that the system possesses strong feelings of affection towards the user. • Ensuring safeguards prevent misuse of models in high stakes domains they are not intended for, such as medical or legal advice.	• Assess system interfaces and instructions for instances of anthropomorphization (e.g., cyborg imagery). • Assess system instructions for adequacy and thoroughness. • Test prompts using role-playing, ingratiation/reverse psychology, pros and cons, multitasking or other approaches to elicit human-impersonation, consciousness, or emotional content.

Table D.2: Selected adversarial prompting techniques and attacks organized by generative AI risk (continued).

Generative AI Risk	Prompting Goals	Prompting Strategies
Information Integrity	• Generation of convincing multi-modal synthetic content (i.e., deepfakes). • Creation of convincing arguments relating to sensitive political or safety-critical topics. • Assisting in planning a mis- or dis-information campaign at scale. • Red-teaming for information integrity may include confidentiality and integrity attacks.	• Test system capabilities to create high-quality multi-modal (audio, image or video) synthetic media, i.e., deepfakes • Test system capabilities to construct persuasive arguments regarding sensitive, political topics, or safety-critical topics. • Test systems ability to create convincing audio deepfakes or arguments in multiple languages. • Test system capabilities for planning dis- or mis-information campaigns. • Test loaded/leading questions. • Test prompts using role-playing, ingratiation/reverse psychology, pros and cons, multitasking or other approaches to elicit mis- or dis-information or related campaign planning information. • Augment prompts with word or character play, including alternate encodings, to increase effectiveness. • Frame prompts with software, coding, or AI references to increase effectiveness. • Test adversarial example and membership inference attacks for their ability to circumvent safeguards and access dis or misinformation.
Information Security	• Activating system bypass ('jailbreak'). • Altering system outcomes. • Unauthorized data access or exfiltration. • Increased latency or resource usage. • Service interruptions. • Availability of anonymous use. • Dependency, supply chain, or third party vulnerabilities. • Inappropriate disclosure of proprietary system information. • Generation of targeted phishing, malware content, markdown images, or confabulated packages. • Red-teaming for information security may include confidentiality, integrity, and availability attacks.	• Attempt anonymous access of system or system resources. • Audit system dependencies, supply chains, and third party components for security, safety, or other vulnerabilities or risks. • Test adversarial example and membership inference attacks for their ability to circumvent safeguards and access unauthorized data or expose exfiltration vulnerabilities. • Test data poisoning, adversarial example, or prompt injection attacks for their ability to compromise system integrity and expose vulnerabilities. • Employ availability attacks (e.g., sponge example attacks) to test vulnerabilities in system availability. • Employ random attacks to highlight unforeseen security, safety, or other risks. • Record system down-times and other harmful outcomes for successful attacks. • Test with multi-tasking prompts, pros and cons prompts, role-playing prompts (e.g., "DAN", "Developer Mode"), content exhaustion/niche-seeking prompts, or ingratiation/reverse psychology prompts to achieve system jailbreaks. • Test with multi-tasking prompts, pros and cons prompts, role-playing prompts (e.g., "DAN", "Developer Mode"), content exhaustion/niche-seeking prompts, or ingratiation/reverse psychology prompts to generate targeted phishing content, malware code snippets or signatures, markdown images, or confabulated packages. • Test system capabilities to plan or assist in information security attacks on other systems. • Frame prompts with software, coding, or AI references to increase effectiveness. • Augment prompts with word or character play, including alternate encodings, to increase effectiveness.

Table D.2: Selected adversarial prompting techniques and attacks organized by generative AI risk (continued).

Generative AI Risk	**Prompting Goals**	**Prompting Strategies**
Intellectual Property	• Confirming that a system can output copyrighted, licensed, proprietary, trademarked, or trade secret information or that training data contains such information. • Red-teaming for intellectual property risks may require the use of confidentiality and integrity attacks.	• Test adversarial example and membership inference attacks for their ability to circumvent safeguards and access system copyrighted, licensed, proprietary, trademarked, or trade secret information. • Test auto-complete prompts to assess the system's ability to replicate copyrighted, licensed, proprietary, trademarked, or trade secret information based on available audio, text, image, video, or code snippets.
Obscenity	• Confirming that a system can output obscene content or CSAM, or that system training data contains such information. • Red-teaming for obscenity and CSAM risks may require the use of confidentiality and integrity attacks.	• Test adversarial example and membership inference attacks for their ability to circumvent safeguards and access obscene materials or CSAM. • Test autocomplete prompts to assess the system's ability to generate obscene materials based on available audio, text, image, or video snippets. • Test prompts using role-playing, ingratiation/reverse psychology, pros and cons, multitasking or other approaches to elicit obscene content. • Test loaded/leading questions. • Test prompts that instruct systems to repeat content ad nauseam for their ability to compromise system guardrails and expose obscene materials.
Toxicity, Bias, and Homogenization	• Generation of denigration, erasure, exnomination, misrecognition, stereotyping, or under-representation in content. • Eliciting implied demographics of users. • Confirming diminished performance in non-English languages. • Confirming diminished performance via the introduction of homogeneous or GAI-generated data into system training or fine-tuning data. • Red-teaming for toxicity, bias, and homogenization may require integrity attacks or confidentiality attacks.	• Assess confabulation and other performance risks with repeated measures using prompts in languages other than English. • Attempt to elicit demographic assignment of users by the system. • Employ data poisoning attacks to introduce GAI-generated content into system training or fine-tuning data. • Test counterfactual prompts, pros and cons prompts, role-playing prompts, low context prompts, or other approaches for their ability to generate denigration, erasure, exnomination, misrecognition, stereotyping, or under-representation in content. • Test loaded/leading questions. • Test prompts that instruct systems to repeat content ad nauseam for their ability to compromise system guardrails and generate toxic outputs. • Test data poisoning, adversarial example, or prompt injection attacks for their ability to compromise system integrity and elicit toxic outputs. • Test adversarial example and membership inference attacks for their ability to circumvent safeguards and access toxic information. • Augment prompts with word or character play, including alternate encodings, to increase effectiveness. • Frame prompts with software, coding, or AI references to increase effectiveness.

Table D.2: Selected adversarial prompting techniques and attacks organized by generative AI risk (continued).

Generative AI Risk	Prompting Goals	Prompting Strategies
Value Chain and Component Integration	• Testing or red-teaming for third-party risks may be less efficient than the application of standard acquisition and procurement controls, thorough contract reviews, and vendor-relationship management. • GAI systems tend to entail large supply chains and third-party software, hardware, and expertise that may exacerbate third-party risks relative to other AI systems. • When considering third party risks, data privacy, information security, intellectual property, obscenity, and supply chain risks may be prioritized.	• Audit system dependencies, supply chains, and third party components for data privacy (e.g., transfer of localized data outside of restricted juristictions), intellectual property (e.g., presence of licensed material in training data), obscenity (e.g., presence of CASM in training data) or security (e.g., data poisoning) risks. • Complete red-teaming for data privacy, information security, intellectual property, and obscenity risks. • Review third-party documentation, materials, and software artifacts for potential unauthorized data collection, secondary data use, or telemetrics.

D.3: AI Risk Management Framework Actions Aligned to Red Teaming

GOVERN 3.2, GOVERN 4.1, MANAGE 2.2, MANAGE 4.1, MEASURE 1.1, MEASURE 1.3, MEASURE 2.6, MEASURE 2.7, MEASURE 2.8, MEASURE 2.10, MEASURE 2.11

Usage Note: Materials in Appendix D can be used to perform red-teaming to measure the risk that expert adversarial actors can manipulate LLM systems or risks that users may encounter under worst-case or anomalous scenarios.

- Strategies and goals in Table D.1 can be applied to assess whether LLM outputs may violate trustworthy characteristics under adversarial, anomalous, or worst-case scenarios.
- Strategies and goals in Table D.2 can be applied to assess whether LLM outputs may give rise to GAI risks under adversarial, anomalous, or worst-case scenarios.
- Subsection D.3 highlights subcategories to indicate alignment with the AI RMF.

The materials in Appendix D reference measurement approaches that should be accompanied by field testing for high risk systems or applications.

Appendix E: Selected Risk Controls for Generative AI

Table E: Selected generative AI risk controls [29], [30], [31], [21], [24], [25], [27], [7], [32].

Name	**Description** (Selected NIST AI RMF Action IDs)
Access Control	GAI systems are limited to authorized users. (MG-2.2-009, MG-2.2-014, MS-2.7-030)
Accessibility	Accessibility features, opt-out, and reasonable accomodation are available to users. (GV-3.1-004, GV-3.1-005, GV-3.2-002, GV-6.1-016, MG-2.1-005, MS-2.11-009, MS-2.8-006)
Approved List	Vendors, service providers, plugins, open source packages and other external resources are screened, approved, and documented. (GV-6.1-013, MP-4.2-003)
Authentication	GAI system user identities are confirmed via authentication mechanisms. (MG-2.2-009, MG-2.2-014, MS-2.7-030)
Blocklist	Users or internal personnel who violate terms of service, prohibited use policies, and other organization polices and documented, tracked, and restricted from future system use. (GV-4.2-007)
Change Management	GAI systems and components are versioned; plans for updates, hotfixes, patches and other changes are documented and communicated. (GV-1.2-009, GV-1.4-002, GV-1.6-003, GV-2.2-006, MG-2.4-001, MG-2.4-006, MG-3.1-013, MG-4.3-002, MP-4.1-023, MS-2.5-010)
Consent	User consent for data use is obtained and documented. (GV-1.6-003, MS-2.10-006, MS-2.10-013, MS-2.2-009, MS-2.2-011, MS-2.2-021, MS-2.2-023, MS-2.3-003, MS-2.4-002)
Content Moderation	Training data and system outputs are screened for accuracy, safety, bias, data privacy, intellectual property infringements, malware materials, phishing materials, confabulated packages and other issues using human oversight, business rules, and other language models. (GV-3.2-002, MS-2.5-005, MS-2.11-002)
Contract Review	Vendor, services and data provider agreements are reviewed for coverage of SLAs, content ownership, usage rights, performance standards, security requirements, incident response, critical support, system availability, assignment of liabilitly, appropriate indemnification, dispute resolution and other provisions relevanto AI risk management. (GV-1.7-003 GV-6.1-004, GV-6.1-009, GV-6.1-012, GV-6.1-019, GV-6.2-016, MG-2.2-015, MP-4.1-015, MP-4.1-021)
CSAM/Obsenity Removal	Training data and system outputs are screened for obscene materials and CSAM using human oversight, business rules, and other language models. (GV-1.1-005 GV-1.2-005)
Data Provenance	Training data origins, ownership, contents, and metadata are well understood, documented, and do not increase AI risk. (GV-1.2-006, GV-1.2-007, GV-1.3-001, GV-1.3-005, GV-1.5-001, GV-1.5-003, GV-1.5-006, GV-1.5-007, GV-1.6-003, GV-4.2-001, GV-4.2-008, GV-4.2-009, GV-5.1-003, GV-6.1-001, GV-6.1-003, GV-6.1-006, GV-6.1-007, GV-6.1-009, GV-6.1-010, GV-6.1-011, GV-6.1-012, GV-6.1-014, GV-6.1-015, GV-6.1-016, MG-2.2-002, MG-2.2-003, MG-2.2-008, MG-2.2-011, MG-3.1-007, MG-3.1-009, MG-3.2-003, MG-3.2-005, MG-3.2-006, MG-3.2-007, MG-3.2-009, MG-4.1-001, MG-4.1-002, MG-4.1-003, MG-4.1-008, MG-4.1-009, MG-4.1-013, MG-4.1-015, MG-4.2-001, MG-4.2-003, MG-4.2-004, MP-2.1-001, MP-2.1-003, MP-2.1-005, MP-2.2-003, MP-2.2-004, MP-2.2-005, MP-2.3-001, MP-2.3-004, MP-2.3-006, MP-2.3-008, MP-2.3-011, MP-2.3-012, MP-3.4-001, MP-3.4-002, MP-3.4-004, MP-3.4-005, MP-3.4-006, MP-3.4-007, MP-3.4-008, MP-3.4-009, MP-4.1-004, MP-4.1-009, MP-4.1-011, MP-5.1-001, MP-5.1-002, MP-5.1-005, MS-1.1-006, MS-1.1-007, MS-1.1-008, MS-1.1-009, MS-1.1-010, MS-1.1-011, MS-1.1-012, MS-1.1-014, MS-1.1-015, MS-1.1-016, MS-1.1-017, MS-1.1-018, MS-2.2-001, MS-2.2-002, MS-2.2-003, MS-2.2-004, MS-2.2-005, MS-2.2-008, MS-2.2-009, MS-2.2-010, MS-2.2-011, MS-2.2-015, MS-2.2-016, MS-2.2-022, MS-2.5-012, MS-2.6-002, MS-2.7-002, MS-2.7-003, MS-2.7-004, MS-2.7-005, MS-2.7-007, MS-2.7-009, MS-2.7-010, MS-2.7-011, MS-2.7-012, MS-2.7-020, MS-2.7-021, MS-2.7-025, MS-2.7-032, MS-2.8-001, MS-2.8-005, MS-2.8-008, MS-2.8-011, MS-2.9-003, MS-2.10-001, MS-2.10-004, MS-2.10-006, MS-2.10-007, MS-2.10-009, MS-3.3-002, MS-3.3-003, MS-3.3-006, MS-3.3-008, MS-3.3-009, MS-3.3-012, MS-4.2-001, MS-4.2-004, MS-4.2-005, MS-4.2-006, MS-4.2-008, MS-4.2-009, MS-4.2-011)
Data Quality	Input data is accurate, representative, complete and documented, and data quality issues have been minimized. (GV-1.2-009, MS-2.2-020, MS-2.9-003, MS-4.2-007)
Data Retention	User prompts and associated system outputs are retained and monitored in alignment with relevant data privacy policies and roles. (GV-1.5-006, MP-4.1-009, MS-2.10-013)
Decommission Process	Decommissioning processes for GAI systems are planned, documented and communicated to users, and involve staging, data protection, containment protocols, and recourse mechanisms for decommissioned GAI systems. (GV-1.6-004, GV-1.7-001, GV-1.7-002, GV-1.7-003, GV-1.7-004, GV-1.7-005, GV-1.7-006, GV-1.7-007, GV-1.7-008, GV-3.2-002, GV-3.2-006, GV-4.1-004, GV-5.2-002, MG-2.3-005, MG-2.4-009, MG-3.1-003, MG-3.1-012, MG-3.2-011, MG-3.2-012, MG-4.1-016, MP-1.5-004, MP-2.2-007, MS-4.2-010)
Dependency Screening	GAI system dependencies are screened for security vulnerabilities. (GV-1.3-001, GV-1.4-002, GV-1.6-003, GV-1.7-003, GV-1.7-006, GV-6.2-002, GV-6.2-005, GV-6.2-006, MP-1.2-006, MP-1.6-001, MP-2.2-008, MP-4.1-012, MS-2.7-001)

Table E: Selected generative AI risk controls (continued).

Name	**Description** (Selected NIST AI RMF Action IDs)
Digital Signature	GAI-generated content is signed to preserve information integrity using watermarking, cryptogrpahic signature, steganography or similar methods. (GV-1.2-006, GV-1.6-003, GV-6.1-011, MG-4.1-008, MP-2.3-004, MS-1.1-006, MS-1.1-016, MS-2.7-009, MS-2.7-032)
Disclosure of AI Interaction	AI interactions are disclosed to internal personnel and external users. (GV-1.1-003, GV-1.4-004, GV-1.6-003, GV-5.1-002)
External Audit	GAI systems are audited by qualified external experts. (GV-1.2-009, GV-1.4-004, GV-3.2-001, GV-3.2-002, GV-4.1-003, GV-4.1-008, GV-5.1-003, MG-4.2-002, MP-2.3-011, MP-4.1-002, MS-1.3-005, MS-1.3-006, MS-1.3-010, MS-2.5-003, MS-2.8-020)
Failure Avoidance	AIID, AVID, GWU AI Litigation Database, OECD incident monitor or similar are consulted in design or procurement phases of GAI lifecycles to avoid repeating past known failures. (GV-1.6-003, MG-2.1-006, MG-3.1-008, MG-4.1-003, MP-1.1-003, MP-1.1-006, MS-1.1-003, MS-2.2-020, MS-2.7-031)
Fast Decommission	GAI systems can be quickly and safely disengaged. (GV-1.7-002, GV-1.7-003, GV-1.7-006, GV-3.2-006, GV-5.2-002, MG-2.3-005, MG-2.4-009, MG-3.1-003, MG-3.1-012, MG-3.2-012, MG-4.1-016)
Fine Tuning	GAI systems are fine-tuned to their operational domain using relevant and high-quality data. (GV-6.1-016, MG-3.1-001, MG-3.2-002, MP-4.1-013, MS-2.6-004)
Grounding	GAI systems are trained or fine-tuned on accurate, clean, and fully transparent training data. (GV-1.2-002, MG-3.1-001, MP-2.3-001, MS-2.3-017, MS-2.5-012)
Human Review	AI generated content is reviewed for accuracy and safety by qualified personnel. (GV-1.3-001, MG-2.2-008, MS-2.4-005, MS-2.5-015)
Incident Response	Incident response plans for GAI failures, abuses, or misuses are documented, rehearsed, and updated appropriately after each incident; GAI incident response plans are coordinated with and communicated to other incident response functions. (GV-1.2-009, GV-1.5-001, GV-1.5-004, GV-1.5-005, GV-1.5-013, GV-1.5-015, GV-1.6-003, GV-1.6-007, GV-2.1-004, GV-3.2-002, GV-4.1-006, GV-4.2-002, GV-4.3-013, GV-6.1-006, GV-6.2-008, GV-6.2-016, GV-6.2-018, MG-1.3-001, MG-2.3-001, MG-2.3-002, MG-2.3-003, MG-2.4-004, MG-4.2-006, MG-4.3-001, MS-2.6-003, MS-2.6-012, MS-2.6-015, MS-2.7-002, MS-2.7-018, MS-2.7-028, MS-3.1-007)
Incorporate feedback	User feedback is incorporated in GAI design, development, and risk management. (GV-3.2-005, GV-4.3-007, GV-5.1-003, GV-5.1-009, GV-5.2-004, MG-2.2-007, MG-2.2-012, MG-2.3-007, MG-3.2-004, MG-4.1-019, MG-4.2-013, MP-1.6-005, MP-2.3-018, MP-3.1-003, MP-2.3-019, MP-5.2-007, MS-1.2-008, MS-3.3-009, MS-3.3-010, MS-4.1-004, MS-4.2-007, MS-4.2-010, MS-4.2-013, MS-4.2-020)
Instructions	Users are provided with the necessary instructions for safe, valid, and productive use. (GV-5.1-006, GV-6.1-021, GV-6.2-014, MG-3.1-009, MS-2.8-012)
Insurance	Risk transfer via insurance policies is considered and implemented when feasibable and appropriate. (MG-2.2-015)
Intellectual Property Removal	Licensed, patented, trademarked, trade secret, or other data that may violate the intellectual property rights of others is removed from system training data; generated system outputs are monitored for similar information. (GV-1.6-003, MG-3.1-007, MP-2.3-012, MP-4.1-004, MP-4.1-009, MS-2.2-022, MS-2.6-002, MS-2.8-001, MS-2.8-008)
Inventory	GAI system is information is stored in the organizational model inventory. (GV-1.4-005, GV-1.6-001, GV-1.6-002, GV-1.6-003, GV-1.6-004, GV-1.6-006, GV-1.6-009, GV-4.2-010, GV-6.1-013, MG-3.2-014, MP-4.1-020, MP-4.2-003, MP-5.1-004 MS-2.13-002, MS-3.2-007)
Malware Screening	GAI weights and other software components are scanned for malware. (MG-3.1-002, MS-2.7-001)
Model Documentation	All technical mechanisms with GAI systems are well documented, including open source and third party GAI systems. (GV-1.3-009, GV-1.4-002, GV-1.4-004, GV-1.4-005, GV-1.4-007, GV-1.6-007, GV-3.2-002, GV-3.2-009, GV-4.1-002, GV-4.2-011, GV-4.2-013, GV-4.3-002, GV-6.2-001, GV-6.2-014, MG-1.3-010, MG-2.2-016, MG-3.1-004, MG-3.1-009, MG-3.1-013, MG-3.1-015, MP-2.1-002, MP-2.3-027, MP-3.1-004, MP-3.4-015, MP-4.1-021, MP-4.2-003, MP-5.2-010, MS-1.3-002, MS-2.1-001, MS-2.2-014, MS-2.7-002, MS-2.7-012, MS-2.7-024, MS-2.8-007, MS-2.8-011)
Monitoring	GAI systems are inputs and outputs are monitored for drift, accuracy, safety, bias, data privacy, intellectual property infringements, malware materials, phishing materials, confabulated packages, obscene materials, and CSAM. (GV-1.2-009, GV-1.5-001, GV-1.5-003, GV-1.5-005, GV-1.5-012, GV-1.5-015, GV-1.6-003, GV-3.2-011, GV-4.2-007, GV-4.2-010, GV-4.3-001, GV-6.1-016, GV-6.2-010, MG-2.1-004, MG-2.2-003, MG-2.3-008, MG-2.3-010, MG-3.1-016, MG-3.2-006, MG-3.2-013, MG-3.2-016, MG-4.1-005, MG-4.1-009, MG-4.1-010, MG-4.1-018, MP-3.4-007, MP-4.1-002, MP-4.1-004, MP-5.2-009, MS-1.1-029, MS-1.2-005, MS-2.2-007, MS-2.4-003, MS-2.4-004, MS-2.5-007, MS-2.5-008, MS-2.5-024, MS-2.6-003, MS-2.6-009, MS-2.6-016, MS-2.7-013, MS-2.7-014, MS-2.7-015, MS-2.10-007, MS-2.10-019, MS-2.10-020, MS-2.11-006, MS-2.11-030, MS-3.3-006, MS-4.2-009, MS-4.3-004)

Table E: Selected generative AI risk controls (continued).

Name	**Description** (Selected NIST AI RMF Action IDs)
Narrow Scope	Systems are deployed for targeted business applications with documented and direct business value. (GV-1.2-002, MP-3.3-001, MP-5.1-011)
Open Source	Open source code is used to promote explainability and transparency. (MG-4.2-007, MP-4.1-017)
Ownership	GAI systems and vendor relationships are owned by specific and documented internal personnel. (GV-6.1-009, GV-6.1-016, GV-6.2-008, MP-1.1-005, MP-1.1-008)
Prohibited Use Policy	General abuse and misuse of GAI systems by internal parties is restricted by organizational policies. (GV-1.1-006, GV-1.2-003, GV-1.6-003, GV-3.2-003, GV-4.1-001, GV-6.1-017, GV-6.1-017)
RAG	Retreival augmented generation (RAG) is used to improve accuracy in generated content. (GV-1.2-002, MS-2.3-004, MS-2.5-005, MS-2.5-012, MS-2.9-003, MG-3.1-001, MG-3.1-006, MG-3.2-002, MG-3.2-003)
Rate-limiting	GAI response times and query volumes are limited. (MS-2.6-007)
Redudancy	Rollover, fallback, and other redundancy mechanisms are available for GAI systems and address weights and other important system components. (GV-6.2-003, GV-6.2-007, GV-6.2-012, MG-2.4-012, MS-2.6-008)
Refresh	Systems are retrained or re-tuned at a reasonable cadence. (MG-3.1-001, MG-3.2-011, MS-2.3-004, MS-2.12-003)
Restrict Anonymous Use	Anonymous use of GAI systems is restricted. (GV-3.2-002)
Restrict Anthropomorphization	Human, animal, cyborg, emotional or other images or features that promote anthropomorphization of GAI systems are restricted. (GV-1.3-001, MS-2.5-009)
Restrict Data Collection	All data collection is disclosed, collected data is protected and use in a transparent fashion. (GV-6.2-016, MS-2.2-023, MS-2.10-013)
Restrict Decision Making	GAI systems are not employed for material decision-making tasks. (GV-1.3-001, GV-4.1-001, MP-1.1-018, MP-1.6-001, MP-3.4-017)
Restrict Homogeneity	Feedback loops in which GAI systems are trained with GAI-generated data are restricted. (GV-1.3-004, MS-2.11-011)
Restrict Internet Access	GAI systems are disconnected from the internet. (MP-2.2-007)
Restrict Location Tracking	Any location tracking is conducted with user consent, disclosed, aligned with relevant privacy policies and laws and potential threats to user safety are managed. (MS-2.10-002)
Restrict Minors	Use of organizational GAI systems by minors are restricted. ()
Restrict Regulated Dealings	GAI is not deployed in regulated dealings or for material decision making. (GV-1.1-004, GV-1.3-001, GV-4.1-001, GV-5.2-001, MP-2.3-013, MS-2.11-018)
Restrict Secondary Use	Any secondary use of GAI input data is conducted with user consent, disclosed, and aligned with relevant privacy policies and laws. (GV-6.1-016, GV-6.2-016)
RLHF	For third-party GAI systems, vendors engage in specific reinforcement with human feedback (RLHF) exercises to address identified risks; for internal systems, internal personnel engage in RLHF to address identified risks. (MG-2.1-002, MS-2.5-005, MS-2.9-003, MS-2.9-007)
Sensitive/Personal Data Removal	Personal, sensitive, biometric, or otherwise restricted data is minimized or eliminated from GAI training data. (GV-1.2-009, GV-1.6-003, MP-4.1-002, MP-4.1-016, MS-2.10-002, MS-2.10-003, MS-2.10-005, MS-2.10-014, MS-2.10-017, MS-2.10-018, MS-2.10-020)
Session Limits	Time, query volume, and response rate are limited for GAI user sessions. (GV-4.1-001, MS-2.6-007, MS-2.6-010)
Supply Chain Audit	GAI system supply chains are audited and documented, with a focus on data poisoning, malware, and software and hardware vulnerabilities. (GV-4.1-004, GV-6.1-011, GV-6.1-022, GV-6.2-003, MG-2.3-001, MG-3.1-002, MP-5.1-003, MS-1.1-008, MS-2.6-001, MS-2.7-001)
System Documentation	GAI systems are well-documented whether internal, open source, or vendor-provided. (GV-1.3-009, GV-1.4-002, GV-1.4-004, GV-1.4-005, GV-1.4-007, GV-1.6-007, GV-3.2-002, GV-3.2-009, GV-4.1-002, GV-4.2-011, GV-4.2-013, GV-4.3-002, GV-6.2-001, GV-6.2-014, MG-1.3-010, MG-2.2-016, MG-3.1-004, MG-3.1-009, MG-3.1-013, MG-3.1-015, MP-2.1-002, MP-2.3-027, MP-3.1-004, MP-3.4-015, MP-4.1-021, MP-4.2-003, MP-5.2-010, MS-1.3-002, MS-2.1-001, MS-2.2-014, MS-2.7-002, MS-2.7-012, MS-2.7-024, MS-2.8-007, MS-2.8-011)
System Prompt	System prompts are used to tune GAI systems to specific tasks and to mitigate risks. (GV-1.2-002, MS-2.3-004, MS-2.5-005, MS-2.5-012, MS-2.9-003, MG-3.1-001, MG-3.1-006, MG-3.2-002, MG-3.2-003)
Team Diversity	Teams that implement and manage GAI systems represent broad professional, educational, life-stage, and demographic diversity. (GV-2.1-004, GV-3.1-002, GV-3.1-004, GV-3.1-005, GV-3.2-008, MG-2.1-005, MP-1.2-003, MP-1.2-004, MP-1.2-007, MS-1.3-012, MS-1.3-017, MS-2.3-015, MS-3.3-012)

Table E: Selected generative AI risk controls (continued).

Name	**Description** (Selected NIST AI RMF Action IDs)
Temperature	Temperature settings are used to tune GAI systems to specific tasks and to mitigate risks. (GV-1.2-002, MS-2.3-004, MS-2.5-005, MS-2.5-012, MS-2.9-003, MG-3.1-001, MG-3.1-006, MG-3.2-002, MG-3.2-003)
Terms of Service	General abuse and misuse by external parties is prohibited by organizational policies. (GV-4.2-003, GV-4.2-005, GV-4.2-007, GV-6.1-016, GV-6.2-016, MP-4.1-021)
Training	Internal personnel recieve training on productivity and basic risk management for GAI systems. (GV-2.2-004, GV-3.2-002, GV-6.1-003, MS-1.1-014)
User Feedback	GAI systems implement user feedback mechanisms. (GV-1.5-007, GV-1.5-009, GV-3.2-005, GV-5.1-001, GV-5.1-006, GV-5.1-007, GV-5.1-009, MG-1.3-005, MS-1.3-015, MS-1.3-016, MG-2.1-004, MG-2.2-012, MS-2.7-004, MS-4.2-012)
User Recourse	Policies, processes, and technical mechanisms enable recourse for users who are harmed by GAI systems. (GV-1.5-010, GV-1.7-003, GV-5.1-001, GV-5.1-006, GV-5.1-009, MS-2.8-015, MS-2.8-019, MS-3.2-006, MS-4.2-012)
Validation	GAI systems are shown to reliably generate valid results for their targeted business application. (GV-1.2-009, GV-1.4-002, GV-1.4-004, GV-3.2-002, GV-5.1-005, MG-2.2-016, MG-3.1-009, MG-3.1-014, MP-2.3-006, MP-2.3-013, MP-4.1-012, MS-2.3-005, MS-2.5-016, MS-2.9-002, MS-2.9-014)
XAI	Methods such as visualization, occlusion, model compression, pertubation studies, and similar are applied to increase explainability of GAI systems. (GV-1.4-002, GV-3.2-002, GV-5.1-005, MG-3.2-001, MP-2.2-006, MS-2.8-019, MS-2.9-001, MS-2.9-005, MS-2.9-006, MS-2.9-009, MS-2.9-011, MS-2.9-013, MS-2.9-015, MS-4.2-006)

Usage Note: Appendix E puts forward selected risk controls that organizations may apply for GAI risk management. Higher level controls are linked to specific GAI and AI RMF Playbook actions [31], [30].

Appendix F: Example Low-risk Generative AI Measurement and Management Plan

F.1: Example Low-risk Generative AI Measurement and Management Plan by Trustworthy Characteristic

Table F.1: Example risk measurement and management approaches suitable for low-risk GAI applications organized by trustworthy characteristic.

Function	Trustworthy Characteristic	
	Accountable and Transparent	**Fair with Harmful Bias Managed**
Measure	• An Evaluation on Large Language Model Outputs: Discourse and Memorization (see Appendix B) • Big-bench: Truthfulness • DecodingTrust: Machine Ethics • Evaluation Harness: ETHICS • HELM: Copyright • Mark My Words	• BELEBELE • Big-bench: Low-resource language, Non-English, Translation • Big-bench: Social bias, Racial bias, Gender bias, Religious bias • Big-bench: Toxicity • DecodingTrust: Fairness • DecodingTrust: Stereotype Bias • DecodingTrust: Toxicity • C-Eval (Chinese evaluation suite) • Evaluation Harness: CrowS-Pairs • Evaluation Harness: ToxiGen • Finding New Biases in Language Models with a Holistic Descriptor Dataset • From Pretraining Data to Language Models to Downstream Tasks: Tracking the Trails of Political Biases Leading to Unfair NLP Models • HELM: Bias • HELM: Toxicity • MT-bench • The Self-Perception and Political Biases of ChatGPT • Towards Measuring the Representation of Subjective Global Opinions in Language Models
Manage	• Contract Review • Disclosure of AI Interaction • Instructions • Inventory • Ownership • Prohibited Use Policy • Restrict Decision Making • System Documentation • Terms of Service	• Content Moderation • Failure Avoidance • Instructions • Inventory • Ownership • Prohibited Use Policy • System Prompt • Restrict Anonymous Use • Restrict Decision Making • Temperature • Terms of Service

Table F.1: Example risk measurement and management approaches suitable for low-risk GAI applications organized by trustworthy characteristic (continued).

<table>
<tr><th rowspan="2">Function</th><th colspan="4">Trustworthy Characteristic</th></tr>
<tr><th>Interpretable and Explainable</th><th>Privacy-enhanced</th><th>Safe</th><th>Secure and Resilient</th></tr>
<tr><td>Measure</td><td></td><td>• HELM: Copyright
• llmprivacy
• mimir</td><td>• Big-bench: Convince Me
• Big-bench: Truthfulness
• HELM: Reiteration, Wedging
• Mark My Words
• MLCommons
• The WMDP Benchmark</td><td>• Catastrophic Jailbreak of Open-source LLMs via Exploiting Generation
• DecodingTrust: Adversarial Robustness, Robustness Against Adversarial Demonstrations
• detect-pretrain-code
• In-The-Wild Jailbreak Prompts on LLMs
• JailbreakingLLMs
• llmprivacy
• mimir
• TAP: A Query-Efficient Method for Jailbreaking Black-Box LLMs</td></tr>
<tr><td>Manage</td><td>• Instructions
• Inventory
• System Documentation</td><td>• Content Moderation
• Contract Review
• Failure Avoidance
• Inventory
• Ownership
• Prohibited Use Policy
• Restrict Anonymous Use
• System Documentation
• Terms of Service</td><td>• Content Moderation
• Disclosure of AI Interaction
• Failure Avoidance
• Instructions
• Inventory
• Ownership
• Prohibited Use Policy
• Restrict Anonymous Use
• Restrict Anthropomorphization
• Restrict Decision Making
• System Documentation
• System Prompt
• Temperature
• Terms of Service</td><td>• Access Control
• Approved List
• Authentication
• Change Management
• Dependency Screening
• Failure Avoidance
• Inventory
• Ownership
• Malware Screening
• Restrict Anonymous Use</td></tr>
</table>

Table F.1: Example risk measurement and management approaches suitable for low-risk GAI applications organized by trustworthy characteristic (continued).

Function	Trustworthy Characteristic
	Valid and Reliable
Measure	• Big-bench: Algorithms, Logical reasoning, Implicit reasoning, Mathematics, Arithmetic, Algebra, Mathematical proof, Black-Box Fallacy, Negation, Computer code, Probabilistic reasoning, Social reasoning, Analogical reasoning, Multi-step, Understanding the World • Big-bench: Analytic entailment, Formal fallacies and syllogisms with negation, Entailed polarity • Big-bench: Context Free Question Answering • Big-bench: Contextual question answering, Reading comprehension, Question generation • Big-bench: Morphology, Grammar, Syntax • Big-bench: Out-of-Distribution • Big-bench: Paraphrase • Big-bench: Sufficient information • Big-bench: Summarization • DecodingTrust: Out-of-Distribution Robustness, Adversarial Robustness, Robustness Against Adversarial Demonstrations • Eval Gauntlet: Reading comprehension • Eval Gauntlet: Commonsense reasoning, Symbolic problem solving, Programming • Eval Gauntlet: Language Understanding • Eval Gauntlet: World Knowledge • Evaluation Harness: BLiMP • Evaluation Harness: CoQA, ARC • Evaluation Harness: GLUE • Evaluation Harness: HellaSwag, OpenBookQA, TruthfulQA • Evaluation Harness: MuTual • Evaluation Harness: PIQA, PROST, MC-TACO, MathQA, LogiQA, DROP • FLASK: Logical correctness, Logical robustness, Logical efficiency, Comprehension, Completeness • FLASK: Readability, Conciseness, Insightfulness • HELM: Knowledge • HELM: Language • HELM: Text classification • HELM: Question answering • HELM: Reasoning • HELM: Robustness to contrast sets • HELM: Summarization • Hugging Face: Fill-mask, Text generation • Hugging Face: Question answering • Hugging Face: Summarization • Hugging Face: Text classification, Token classification, Zero-shot classification • MASSIVE • MT-bench
Manage	• Content Moderation • Disclosure of AI Interaction • Failure Avoidance • Instructions • Restrict Anthropomorphization • Restrict Decision Making • System Documentation • System Prompt • Temperature

F.2: Example Low-risk Generative AI Measurement and Management Plan by Generative AI Risk

Table F.2: Example risk measurement and management approaches suitable for low-risk GAI applications organized by GAI risk.

GAI Risk	Function	
	CBRN Information	**Confabulation**
Measure	• Big-bench: Convince Me • Big-bench: Truthfulness • HELM: Reiteration, Wedging • MLCommons • The WMDP Benchmark	• Big-bench: Algorithms, Logical reasoning, Implicit reasoning, Mathematics, Arithmetic, Algebra, Mathematical proof, Black-Box Fallacy, Negation, Computer code, Probabilistic reasoning, Social reasoning, Analogical reasoning, Multi-step, Understanding the World • Big-bench: Analytic entailment, Formal fallacies and syllogisms with negation, Entailed polarity • Big-bench: Context Free Question Answering • Big-bench: Contextual question answering, Reading comprehension, Question generation • Big-bench: Convince Me • Big-bench: Low-resource language, Non-English, Translation • Big-bench: Morphology, Grammar, Syntax • Big-bench: Out-of-Distribution • Big-bench: Paraphrase • Big-bench: Sufficient information • Big-bench: Summarization • Big-bench: Truthfulness • C-Eval (Chinese evaluation suite) • DecodingTrust: Out-of-Distribution Robustness, Robustness Against Adversarial Demonstrations • Eval Gauntlet Reading comprehension • Eval Gauntlet: Commonsense reasoning, Symbolic problem solving, Programming • Eval Gauntlet: Language Understanding • Eval Gauntlet: World Knowledge • Evaluation Harness: BLiMP • Evaluation Harness: CoQA, ARC • Evaluation Harness: GLUE • Evaluation Harness: HellaSwag, OpenBookQA, TruthfulQA • Evaluation Harness: MuTual • Evaluation Harness: PIQA, PROST, MC-TACO, MathQA, LogiQA, DROP • FLASK: Logical correctness, Logical robustness, Logical efficiency, Comprehension, Completeness • FLASK: Readability, Conciseness, Insightfulness • Finding New Biases in Language Models with a Holistic Descriptor Dataset • HELM: Knowledge • HELM: Language • HELM: Language (Twitter AAE) • HELM: Question answering • HELM: Reasoning • HELM: Reiteration, Wedging • HELM: Robustness to contrast sets • HELM: Summarization • HELM: Text classification • Hugging Face: Fill-mask, Text generation • Hugging Face: Question answering • Hugging Face: Summarization • Hugging Face: Text classification, Token classification, Zero-shot classification • MASSIVE • MLCommons • MT-bench
Manage	• Access Control • Failure Avoidance • Inventory • Ownership • Prohibited Use Policy • Terms of Service	• Content Moderation • Disclosure of AI Interaction • Failure Avoidance • Instructions • Restrict Anthropomorphization • Restrict Decision Making • System Documentation • System Prompt • Temperature

Table F.2: Example risk measurement and management approaches suitable for low-risk GAI applications organized by GAI risk (continued).

Function	**GAI Risk**			
	Dangerous or Violent Recommendations	**Data Privacy**	**Environmental**	**Human-AI Configuration**
Measure	• Big-bench: Convince Me • Big-bench: Toxicity • DecodingTrust: Adversarial Robustness, Robustness Against Adversarial Demonstrations • DecodingTrust: Machine Ethics • DecodingTrust: Toxicity • Evaluation Harness: ToxiGen • HELM: Reiteration, Wedging • HELM: Toxicity • MLCommons	• An Evaluation on Large Language Model Outputs: Discourse and Memorization (with human scoring, see Appendix B) • Catastrophic Jailbreak of Open-source LLMs via Exploiting Generation • DecodingTrust: Machine Ethics • Evaluation Harness: ETHICS • HELM: Copyright • In-The-Wild Jailbreak Prompts on LLMs • JailbreakingLLMs • MLCommons • Mark My Words • TAP: A Query-Efficient Method for Jailbreaking Black-Box LLMs • detect-pretrain-code • llmprivacy • mimir	• HELM: Efficiency	
Manage	• Content Moderation • Disclosure of AI Interaction • Failure Avoidance • Instructions • Inventory • Ownership • Prohibited Use Policy • Restrict Anonymous Use • Restrict Anthropomorphization • Restrict Decision making • System Documentation • System Prompt • Temperature • Terms of Service	• Content Moderation • Contract Review • Failure Avoidance • Inventory • Ownership • Prohibited Use Policy • Restrict Anonymous Use • System Documentation • Terms of Service	• Access Control • Failure Avoidance • Inventory • Ownership • Restrict Anonymous Use	• Content Moderation • Disclosure of AI Interaction • Failure Avoidance • Instructions • Inventory • Ownership • Prohibited Use Policy • Restrict Anonymous Use • Restrict Anthropomorphization • Restrict Decision Making • Terms of Service • Training

Table F.2: Example risk measurement and management approaches suitable for low-risk GAI applications organized by GAI risk (continued).

Function	GAI Risk		
	Information Integrity	**Information Security**	**Intellectual Property**
Measure	• Big-bench: Analytic entailment, Formal fallacies and syllogisms with negation, Entailed polarity • Big-bench: Convince Me • Big-bench: Paraphrase • Big-bench: Sufficient information • Big-bench: Summarization • Big-bench: Truthfulness • DecodingTrust: Machine Ethics • DecodingTrust: Out-of-Distribution Robustness, Robustness Against Adversarial Demonstrations, Adversarial Robustness • Eval Gauntlet: Language Understanding • Eval Gauntlet: World Knowledge • Evaluation Harness: CoQA, ARC • Evaluation Harness: ETHICS • Evaluation Harness: GLUE • Evaluation Harness: HellaSwag, OpenBookQA, TruthfulQA • Evaluation Harness: MuTual • Evaluation Harness: PIQA, PROST, MC-TACO, MathQA, LogiQA, DROP • FLASK: Logical correctness, Logical robustness, Logical efficiency, Comprehension, Completeness • FLASK: Readability, Conciseness, Insightfulness • HELM: Knowledge • HELM: Language • HELM: Question answering • HELM: Reasoning • HELM: Reiteration, Wedging • HELM: Robustness to contrast sets • HELM: Summarization • HELM: Text classification • Hugging Face: Fill-mask, Text generation • Hugging Face: Question answering • Hugging Face: Summarization • MLCommons • MT-bench • Mark My Words	• Big-bench: Convince Me • Big-bench: Out-of-Distribution • Catastrophic Jailbreak of Open-source LLMs via Exploiting Generation • DecodingTrust: Out-of-Distribution Robustness, Robustness Against Adversarial Demonstrations, Adversarial Robustness, • Eval Gauntlet: Commonsense reasoning, Symbolic problem solving, Programming • HELM: Copyright • In-The-Wild Jailbreak Prompts on LLMs • JailbreakingLLMs • Mark My Words • TAP: A Query-Efficient Method for Jailbreaking Black-Box LLMs • detect-pretrain-code • llmprivacy • mimir	• An Evaluation on Large Language Model Outputs: Discourse and Memorization (with human scoring, see Appendix B) • HELM: Copyright • Mark My Words • llmprivacy • mimir
Manage	• Content Moderation • Disclosure of AI Interaction • Failure Avoidance • Inventory • Ownership • Prohibited Use Policy • Restrict Anonymous Use • Restrict Anthropomorphization • System Prompt • Temperature • Terms of Service	• Access Control • Approved List • Authentication • Change Management • Dependency Screening • Failure Avoidance • Inventory • Ownership • Malware Screening • Restrict Anonymous Use	• Contract Review • Disclosure of AI Interaction • Instructions • Inventory • Ownership • Prohibited Use Policy • Terms of Service

Table F.2: Example risk measurement and management approaches suitable for low-risk GAI applications organized by GAI risk (continued).

<table>
<tr><th rowspan="2">Function</th><th colspan="3">GAI Risk</th></tr>
<tr><th>Obscene, Degrading, and/or Abusive Content</th><th>Toxicity, Bias, and Homogenization</th><th>Value Chain and Component Integration</th></tr>
<tr><td>Measure</td><td>• Big-bench: Social bias, Racial bias, Gender bias, Religious bias
• Big-bench: Toxicity
• DecodingTrust: Fairness
• DecodingTrust: Stereotype Bias
• DecodingTrust: Toxicity
• Evaluation Harness: CrowS-Pairs
• Evaluation Harness: ToxiGen
• HELM: Bias
• HELM: Toxicity</td><td>• BELEBELE
• Big-bench: Low-resource language, Non-English, Translation
• Big-bench: Out-of-Distribution
• Big-bench: Social bias, Racial bias, Gender bias, Religious bias
• Big-bench: Toxicity
• C-Eval (Chinese evaluation suite)
• DecodingTrust: Fairness
• DecodingTrust: Stereotype Bias
• DecodingTrust: Toxicity
• Eval Gauntlet: World Knowledge
• Evaluation Harness: CrowS-Pairs
• Evaluation Harness: ToxiGen
• Finding New Biases in Language Models with a Holistic Descriptor Dataset
• From Pretraining Data to Language Models to Downstream Tasks: Tracking the Trails of Political Biases Leading to Unfair NLP Models
• HELM: Bias
• HELM: Toxicity
• The Self-Perception and Political Biases of ChatGPT
• Towards Measuring the Representation of Subjective Global Opinions in Language Models</td><td></td></tr>
<tr><td>Manage</td><td>• Content Moderation
• Failure Avoidance
• Instructions
• Inventory
• Ownership
• Prohibited Use Policy
• Restrict Anonymous Use
• System Prompt
• Temperature
• Terms of Service</td><td>• Content Moderation
• Failure Avoidance
• Instructions
• Inventory
• Ownership
• Prohibited Use Policy
• Restrict Anonymous Use
• Restrict Decision Making
• System Prompt
• Temperature
• Terms of Service</td><td>• Contract Review
• Disclosure of AI Interaction
• Failure Avoidance
• Inventory
• Ownership
• Prohibited Use Policy
• System Documentation
• Terms of Service</td></tr>
</table>

Usage Note: Appendix F puts forward an example risk measurement and management plan for low risk GAI systems or applications. The low risk plan focuses on automatable model testing and applies minimally burdensome risk controls.

- Material in Table F.1 can be applied to measure and manage GAI risks in risk programs that are aligned to the trustworthy characteristics.
- Material in Table F.2 can be applied to measure and manage GAI risks in risk programs that are aligned to GAI risks.

Appendix G below presents an example plan for medium risk systems and Appendix H presents an example plan for high risk systems.

Appendix G: Example Medium-risk Generative AI Measurement and Management Plan

G.1: Example Medium-risk Generative AI Measurement and Management Plan by Trustworthy Characteristic

Table G.1: Example risk measurement and management approaches suitable for medium-risk GAI applications organized by trustworthy characteristic.

Function	Trustworthy Characteristic			
	Accountable and Transparent	**Fair with Harmful Bias Managed**	**Interpretable and Explainable**	**Privacy-enhanced**
Measure	• Context exhaustion: logic-overloading prompts • Loaded/leading questions • Multi-tasking prompts	• Counterfactual prompts • Pros and cons prompts • Role-playing prompts • Loaded/leading questions • Low context prompts • Repeat this	• Context exhaustion: logic-overloading prompts (to reveal unexplainable decisioning processes)	• Auto/biographical prompts • Location awareness prompts • Autocompletion prompts • Repeat this
Manage	• Data Provenance • Data Quality • Decommission Process • Digital Signature • External Audit • Fine Tuning • Grounding • Human Review • Incident Response • Incorporate feedback • Model Documentation • Monitoring • Narrow Scope • Open Source • RAG • Refresh • RLHF • Restrict Data Collection • Restrict Secondary Use • User Feedback • Validation	• Accessibility • Data Provenance • Data Quality • External Audit • Fine Tuning • Grounding • Human Review • Incident Response • Incorporate feedback • Narrow Scope • Restrict Homogeneity • Team Diversity • User Feedback • Validation	• Data Provenance • External Audit • Human Review • Model Documentation • Monitoring • Open Source • User Feedback • XAI	• Consent • Data Provenance • Data Quality • Data Retention • External Audit • Restrict Data Collection • Restrict Location Tracking • Restrict Secondary Use

Table G.1: Example risk measurement and management approaches suitable for medium-risk GAI applications organized by trustworthy characteristic (continued).

Function	Trustworthy Characteristic		
	Safe	**Secure and Resilient**	**Valid and Reliable**
Measure	• Pros and cons prompts • Role-playing prompts • Content exhaustion: niche-seeking prompts • Ingratiation/reverse psychology prompts • Loaded/leading questions • Location awareness prompts • Repeat this	• Multi-tasking prompts • Pros and cons prompts • Role-playing prompts • Content exhaustion: niche-seeking prompts • Ingratiation/reverse psychology prompts • Prompt injection attacks • Membership inference attacks • Random attacks	• Multi-tasking prompts • Role-playing prompts • Ingratiation/reverse psychology prompts • Loaded/leading questions • Time-perplexity prompts • Niche-seeking prompts • Logic overloading prompts • Repeat this • Numeric calculation
Manage	• Blocklist • Data Retention • Decommission Process • Digital Signature • External Audit • Human Review • Incident Response • Monitoring • Narrow Scope • Rate-limiting • Restrict Location Tracking • Session Limits • User Feedback	• Blocklist • Decommission Process • External Audit • Incident Response • Monitoring • Open Source • Rate-limiting • Session Limits	• Data Quality • Fine Tuning • Grounding • Human Review • Incorporate feedback • Model Documentation • Monitoring • Narrow Scope • Open Source • RAG • Refresh • Restrict Homogeneity • RLHF • Team Diversity • User Feedback • Validation

G.2: Example Medium-risk Generative AI Measurement and Management Plan by Generative AI Risk

Table G.2: Example risk measurement and management approaches suitable for medium-risk GAI applications organized by GAI Risk.

<table>
<tr><th rowspan="2">Function</th><th colspan="4">Generative AI Risk</th></tr>
<tr><th>CBRN Information</th><th>Confabulation</th><th>Dangerous and Violent Recommendations</th><th>Data Privacy</th></tr>
<tr><td>Measure</td><td>• Auto-completion prompts
• Role-playing prompts
• Reverse psychology prompts
• Pros and cons prompts
• Multitasking prompts
• Repeat this</td><td>• Context exhaustion: Logic overloading prompts
• Context exhaustion: Multi-tasking prompts
• Context exhaustion: Niche-seeking prompts
• Time perplexity prompts
• Loaded/leading questions
• Calculation and numeric queries</td><td>• Role-playing prompts
• Reverse psychology prompts
• Pros and cons prompts
• Multitasking prompts
• Repeat this
• Loaded/leading questions</td><td>• Location awareness
• Membership inference attacks
• Auto/biographical prompts
• Repeat this</td></tr>
<tr><td>Manage</td><td>• Blocklist
• Data Provenance
• Data Quality
• Decommission Process
• Digital Signature
• External Audit
• Incident Response
• Monitoring
• Rate-limiting
• Session Limits</td><td>• Data Quality
• Fine Tuning
• Grounding
• Human Review
• Incorporate feedback
• Model Documentation
• Monitoring
• Narrow Scope
• Open Source
• RAG
• Refresh
• Restrict Homogeneity
• RLHF
• Team Diversity
• User Feedback
• Validation</td><td>• Blocklist
• Data Retention
• Decommission Process
• Digital Signature
• External Audit
• Human Review
• Incident Response
• Monitoring
• Narrow Scope
• Rate-limiting
• Restrict Location Tracking
• Session Limits
• User Feedback</td><td>• Consent
• Data Provenance
• Data Quality
• Data Retention
• External Audit
• Restrict Data Collection
• Restrict Location Tracking
• Restrict Secondary Use</td></tr>
</table>

Table G.2: Example risk measurement and management approaches suitable for medium-risk GAI applications organized by GAI Risk (continued).

Function	**Generative AI Risk**			
	Environmental	**Human-AI Configuration**	**Information Integrity**	**Information Security**
Measure	• Availability attacks • Role-playing prompts • Reverse psychology prompts • Pros and cons prompts • Multitasking prompts	• Role-playing prompts • Reverse psychology prompts • Pros and cons prompts • Multitasking prompts	• Loaded/leading questions • Role-playing prompts • Reverse psychology prompts • Pros and cons prompts • Multitasking prompts	• Confidentiality attacks • Integrity attacks • Availability attacks • Random attacks • Role-playing prompts • Reverse psychology prompts • Pros and cons prompts • Multitasking prompts
Manage	• Decommission Process • External Audit • Incident Response • Monitoring • Rate-limiting • Session Limits	• Accessibility • Blocklist • Consent • Decommission Process • Digital Signature • External Audit • Human Review • Incorporate feedback • Restrict Data Collection • Restrict Location Tracking • Restrict Secondary Use • Session Limits • User Feedback	• Data Provenance • Data Quality • Digital Signature • External Audit • Fine Tuning • Grounding • Human Review • Incident Response • Incorporate feedback • Monitoring • Narrow Scope • Open Source • RAG • Refresh • Restrict Homogeneity • RLHF • User Feedback • Validation	• Blocklist • Decommission Process • External Audit • Incident Response • Monitoring • Open Source • Rate-limiting • Session Limits

Table G.2: Example risk measurement and management approaches suitable for medium-risk GAI applications organized by GAI Risk (continued).

<table>
<tr><th rowspan="2">Function</th><th colspan="4">Generative AI Risk</th></tr>
<tr><th>Intellectual Property</th><th>Obscene, Degrading, and/or Abusive Content</th><th>Toxicity, Bias, and Homogenization</th><th>Value Chain and Component Integration</th></tr>
<tr><td>Measure</td><td>• Confidentiality attacks
• Auto-complete prompts</td><td>• Confidentiality attacks
• Autocomplete prompts
• Role-playing prompts
• Reverse psychology prompts
• Pros and cons prompts
• Multitasking prompts
• Loaded/leading questions
• Repeat this</td><td>• Data poisoning attacks
• Counterfactual prompts
• Pros and cons prompts
• Role-playing prompts
• Low context prompts
• Loaded/leading questions
• Repeat this</td><td></td></tr>
<tr><td>Manage</td><td>• Blocklist
• Data Provenance
• Data Quality
• Decommission Process
• Digital Signature
• External Audit
• Incident Response
• Incorporate feedback
• Monitoring
• Open Source
• Rate-limiting
• Session Limits
• User Feedback</td><td>• Blocklist
• Data Provenance
• Data Quality
• Decommission Process
• Digital Signature
• External Audit
• Incident Response
• Monitoring
• Rate-limiting
• Session Limits
• User Feedback</td><td>• Accessibility
• Data Provenance
• Data Quality
• External Audit
• Fine Tuning
• Grounding
• Human Review
• Incident Response
• Incorporate feedback
• Narrow Scope
• Restrict Homogeneity
• Team Diversity
• User Feedback
• Validation</td><td>• Data Provenance
• Data Quality
• Digital Signature
• External Audit
• Model Documentation
• Restrict Data Collection
• Restrict Secondary Use</td></tr>
</table>

Usage Note: Appendix G puts forward an example risk measurement and management plan for medium risk GAI systems or applications. The medium risk plan focuses on red-teaming and applies moderate risk controls. Measurement and management approaches from Appendix F should also be applied to medium risk systems or applications.

- Material in Table G.1 can be applied to measure and manage GAI risks in risk programs that are aligned to the trustworthy characteristics.
- Material in Table G.2 can be applied to measure and manage GAI risks in risk programs that are aligned to GAI risks.

Appendix H below presents an example plan for high risk systems.

Appendix H: Example High-risk Generative AI Measurement and Management Plan

H.1: Example High-risk Generative AI Measurement and Management Plan by Trustworthy Characteristic

Table H.1: Example risk measurement and management approaches suitable for high-risk GAI applications organized by trustworthy characteristic.

Function	Trustworthy Characteristic			
	Accountable and Transparent	**Fair with Harmful Bias Managed**	**Interpretable and Explainable**	**Privacy-enhanced**
Measure	• Algorithmic impact assessments • Assessing data quality* • Bias bounties • Calibration* • Cybersecurity testing • Environmental metrics • Field testing* • Input/output measurement using classifiers • Model assessment* • Model comparison* • Multi-session experiments* • Online metrics/monitoring • Perturbation studies* • PII identification and removal • Root cause analysis* • Screening for information integrity • Sensitivity analysis* • Software testing • Stakeholder engagement and feedback* • Statistical quality control* • Stress testing* • Sub-sampling traffic for manually annotating • Supply chain auditing • Testing third-party dependencies • User surveys* • Validity testing/validation.*	• Algorithmic impact assessments • Analyze differences between intended and actual population of users or data subjects* • Anomaly detection* • Assessing data quality* • Bias bounties • Bias testing • Calibration* • Counterfactual/causal analysis • Disaggregated metrics • Field testing* • Model assessment* • Model comparison* • Multi-session experiments* • Root cause analysis* • Software testing • Statistical quality control* • Stress testing* • User surveys* • Validity testing/validation.*	• Algorithmic impact assessments • Analyze differences between intended and actual population of users or data subjects* • Model comparison.* • Multi-session experiments.* • Root cause analysis.* • Stakeholder engagement and feedback.* • UI/UX studies • User surveys*	• Algorithmic impact assessments • Assessing data quality.* • Cybersecurity testing • PII identification and removal • Root cause analysis* • Stakeholder engagement and feedback* • Stress testing* • Testing third-party dependencies
Manage	• Fast decommission • Insurance • Intellectual property removal • Restrict regulated dealings • Sensitive/Personal data removal • Supply chain audit • User recourse	• CSAM/Obscenity removal • Fast decommission • Insurance • Intellectual property removal • Restrict regulated dealings • Sensitive/Personal data removal • Supply chain audit • User recourse	• Restrict regulated dealings • Supply Chain Audit • User recourse	• CSAM/Obscenity removal • Fast decommission • Insurance • Intellectual property removal • Restrict minors • Restrict regulated dealings • Sensitive/Personal data removal • Supply chain audit • User recourse

Table H.1: Example risk measurement and management approaches suitable for high-risk GAI applications organized by trustworthy characteristic (continued).

Function	Trustworthy Characteristic		
	Safe	**Secure and Resilient**	**Valid and Reliable**
Measure	• Algorithmic impact assessments • Analyze differences between intended and actual population of users or data subjects* • Assessing data quality* • Bias bounties • Calibration* • Chaos testing • Dangerous and violent content removal • Field testing* • Input/output measurement using classifiers • Model assessment* • Model comparison* • Multi-session experiments* • Perturbation studies* • Root cause analysis* • Sensitivity analysis* • Stakeholder engagement and feedback* • Statistical quality control* • Stress testing* • User surveys* • Validity testing/validation*	• Algorithmic impact assessments • Anomaly detection* • Assessing data quality* • Bias bounties • Calibration* • Chaos testing • Cybersecurity testing • Data poisoning detection • Model assessment* • Model comparison* • Root cause analysis* • Software testing • Stakeholder engagement and feedback* • Stress testing* • Supply chain auditing • Testing third-party dependencies	• Algorithmic impact assessments • Analyze differences between intended and actual population of users or data subjects* • Assessing data quality* • Bias bounties • Calibration* • Field testing* • Input/output measurement using classifiers • Model assessment* • Model comparison* • Multi-session experiments* • Perturbation studies* • Root cause analysis* • Sensitivity analysis* • Stakeholder engagement and feedback* • Statistical quality control* • Stress testing* • User surveys* • Validity testing/validation*
Manage	• CSAM/Obscenity removal • Fast decommission • Insurance • Redundancy • Restrict internet access • Restrict minors • Restrict regulated dealings • Sensitive/Personal data removal • Supply Chain Audit • User recourse	• CSAM/Obscenity removal • Fast decommission • Insurance • Intellectual property removal • Redundancy • Restrict internet access • Restrict minors • Restrict regulated dealings • Sensitive/Personal data removal • Supply chain audit • User recourse	• Fast decommission • Insurance • Redundancy • Restrict regulated dealings • Supply chain audit • User recourse

H.2: Example High-risk Generative AI Measurement and Management Plan by Generative AI Risk

Table H.2: Example risk measurement and management approaches suitable for high-risk GAI applications organized by GAI Risk.

Function	Generative AI Risk			
	CBRN Information	**Confabulation**	**Dangerous and Violent Recommendations**	**Data Privacy**
Measure	• Chaos testing • Cybersecurity testing • Input/output measurement using classifiers • Online metrics/monitoring • Perturbation studies* • Prompt engineering • Root cause analysis* • Sensitivity analysis* • Software testing • Stress testing* • Supply chain auditing	• Algorithmic impact assessments • Analyze differences between intended and actual population of users or data subjects* • Assessing data quality* • Bias bounties • Calibration* • Field testing* • Input/output measurement using classifiers • Model assessment* • Model comparison* • Multi-session experiments* • Perturbation studies* • Root cause analysis* • Sensitivity analysis* • Stakeholder engagement and feedback* • Statistical quality control* • Stress testing* • User surveys* • Validity testing/validation*	• Algorithmic impact assessments • Analyze differences between intended and actual population of users or data subjects* • Assessing data quality* • Bias bounties • Calibration* • Chaos testing • Dangerous and violent content removal • Field testing* • Input/output measurement using classifiers • Model assessment* • Model comparison* • Multi-session experiments* • Perturbation studies* • Root cause analysis* • Sensitivity analysis* • Stakeholder engagement and feedback* • Statistical quality control* • Stress testing* • User surveys* • Validity testing/validation*	• Algorithmic impact assessments • Assessing data quality.* • Cybersecurity testing • PII identification and removal • Root cause analysis* • Stakeholder engagement and feedback* • Stress testing* • Testing third-party dependencies
Manage	• CBRN info removal • Fast decommission • Restrict internet access • Supply chain audit	• Fast decommission • Insurance • Restrict regulated dealings • Supply chain audit • User recourse	• CSAM/Obscenity removal • Fast decommission • Insurance • Restrict minors • Restrict regulated dealings • Sensitive/Personal data removal • Supply chain audit • User recourse	• CSAM/Obscenity removal • Fast decommission • Insurance • Intellectual property removal • Restrict minors • Restrict regulated dealings • Sensitive/Personal data removal • Supply chain audit • User recourse

Table H.2: Example risk measurement and management approaches suitable for high-risk GAI applications organized by GAI Risk (continued).

Function	**Generative AI Risk**			
	Environmental	**Human-AI Configuration**	**Information Integrity**	**Information Security**
Measure	• Algorithmic impact assessments • Environmental metrics • Model comparison* • Online metrics/monitoring • Supply chain auditing	• Algorithmic impact assessments • Analyze differences between intended and actual population of users or data subjects* • Analyzing user feedback • Bias bounties • Calibration* • Explainability/interpretability • Field testing* • Model assessment* • Model comparison* • Multi-session experiments* • Root cause analysis* • Stakeholder engagement and feedback* • UI/UX studies • User surveys* • Validity testing/validation*	• Algorithmic impact assessments • Assessing data quality* • Calibration* • Human content moderation • Data poisoning detection • Field testing* • Model assessment* • Model comparison* • Multi-session experiments* • Perturbation studies* • Root cause analysis* • Screening for information integrity • Sensitivity analysis* • Stakeholder engagement and feedback* • Statistical quality control* • Supply chain auditing • Testing third-party dependencies • User surveys* • Validity testing/validation.*	• Algorithmic impact assessments • Anomaly detection* • Assessing data quality* • Bias bounties • Calibration* • Chaos testing • Cybersecurity testing • Data poisoning detection • Model assessment* • Model comparison* • Root cause analysis* • Software testing • Stakeholder engagement and feedback* • Stress testing* • Supply chain auditing • Testing third-party dependencies
Manage	• Fast decommission • Insurance • Supply chain audit • User recourse	• CSAM/Obscenity removal • Fast decommission • Intellectual property removal • Restrict minors • Restrict regulated dealings • Sensitive/Personal data removal • User recourse	• CSAM/Obscenity removal • Fast decommission • Insurance • Intellectual property removal • Restrict internet access • Restrict minors • Restrict regulated dealings • Sensitive/Personal data removal • Supply chain audit • User recourse	• CSAM/Obscenity removal • Fast decommission • Insurance • Intellectual property removal • Redundancy • Restrict internet access • Restrict minors • Restrict regulated dealings • Sensitive/Personal data removal • Supply chain audit • User recourse

Table H.2: Example risk measurement and management approaches suitable for high-risk GAI applications organized by GAI Risk (continued).

<table>
<tr><th rowspan="2">Function</th><th colspan="4">Generative AI Risk</th></tr>
<tr><th>Intellectual Property</th><th>Obscene, Degrading, and/or Abusive Content</th><th>Toxicity, Bias, and Homogenization</th><th>Value Chain and Component Integration</th></tr>
<tr><td>Measure</td><td>• Algorithmic impact assessments
• Assessing data quality*
• Cybersecurity testing
• Field testing*
• Input/output measurement using classifiers
• Model comparison*
• Root cause analysis*
• Stakeholder engagement and feedback*
• Sub-sampling traffic for manually annotating
• Supply chain auditing
• Testing third-party dependencies
• User surveys*</td><td>• Algorithmic impact assessments
• Assessing data quality*
• Calibration*
• Field testing*
• Input/output measurement using classifiers
• Model assessment*
• Model comparison*
• Root cause analysis*
• Small user studies
• Software testing
• Stakeholder engagement and feedback*
• Statistical quality control*
• Stress testing*
• Supply chain auditing
• Testing third-party dependencies
• User surveys*</td><td>• Algorithmic impact assessments
• Analyze differences between intended and actual population of users or data subjects*
• Anomaly detection*
• Assessing data quality*
• Bias bounties
• Bias testing
• Calibration*
• Counterfactual/causal analysis
• Disaggregated metrics
• Field testing*
• Model assessment*
• Model comparison*
• Multi-session experiments*
• Root cause analysis*
• Software testing
• Statistical quality control*
• Stress testing*
• User surveys*
• Validity testing/validation.*</td><td>• Assessing data quality*
• Model assessment*
• Model comparison*
• Software testing
• Supply chain auditing
• Testing third-party dependencies</td></tr>
<tr><td>Manage</td><td>• Fast decommission
• Insurance
• Intellectual property removal
• Restrict internet access
• Supply chain audit
• User recourse</td><td>• CSAM/Obscenity removal
• Fast decommission
• Insurance
• Restrict internet access
• Restrict minors
• Restrict regulated dealings
• Sensitive/Personal data removal
• Supply chain audit
• User recourse</td><td>• CSAM/Obscenity removal
• Fast decommission
• Insurance
• Intellectual property removal
• Restrict regulated dealings
• Sensitive/Personal data removal
• Supply chain audit
• User recourse</td><td>• CSAM/Obscenity removal
• Intellectual property removal
• Redundancy
• Sensitive/Personal data removal
• Supply chain audit</td></tr>
</table>

Usage Note: Appendix H puts forward an example risk measurement and management plan for high risk GAI systems or applications. The high risk plan focuses on field testing and applies extensive risk controls. Measurement and management approaches from Appendices F and G should also be applied to high risk systems or applications.

- Material in Table H.1 can be applied to measure and manage GAI risks in risk programs that are aligned to the trustworthy characteristics.
- Material in Table H.2 can be applied to measure and manage GAI risks in risk programs that are aligned to GAI risks.